# Comparison between radionuclide angiography and Tissue Doppler Imaging for the Evaluation of Intra-Left Ventricular Asynchrony

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## Background

Cardiac resynchronization therapy (CRT) by means of biventricular pacing has been proven effective in ameliorating symptoms and reducing mortality in patients (p) with symptomatic congestive heart failure (CHF) despite optimal medical therapy. Selection of patients who will benefit from pacing represents a crucial issue since echocardiographic indexes lack some sensitivity in specific clinical settings and are highly operator-dependent.

Fauchier et al and Dalle Mule et al demonstrated that radionuclide angiography may be highly accurate in predicting major cardiac events in patients with intraventricular dyssynchrony and may identify reverse remodeling after biventricular pacing.

On the other hand, Yu et al demonstrated that a 32 ms interval of the standard deviation of TDI contraction evaluation may totally segregate responders to CRT

One of the caveats of any method for the evaluation of ventricular asynchrony is the lack of discrimination within the etiologic factors of asynchrony itself, particularly when this feature may be due to CAD in the presence of segmental contraction abnormalities. This may be crucial for the identification of responders to cardiac resyncronization therapy.

## Aim

To evaluate the reliability of two novel radionuclide angiography (RNA) phase analysis indexes of cardiac asynchrony, - **synchrony (S) and entropy (E),** when compared to tissue Doppler imaging (TDI) evaluation of dyssynchrony in patients with CHF.

This study has been conceived to evaluate at long-term follow up the value of S and E in identifying responders to CRT.

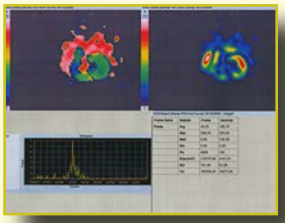
## Patients n=10

| | |
|---|---|
| Age | 67±9 |
| M/F | 6/4 |
| NYHA 2/3 | 3/7 |
| CAD/IDC | 5/5 |

## Methods

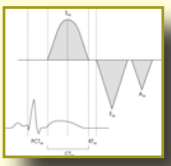
### RNA

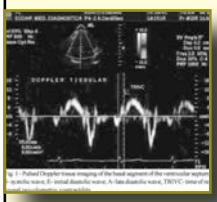
*RNA planar studies were performed with a Siemens e-cam dual-head camera, (best-septal LAO $^{99m}$Tc-labelled red blood cells, 740 MBq i.v., 64x64 matrix size, 24 frames/cycle, 6000 KCounts). Phase images were generated on first Fourier harmonic fit of the time-activity curve of the cardiac cycle, drawing a region of interest on the end-diastolic frame for right ventricle (RV) and LV. Analysis of the phase histogram was performed with a commercial software calculating the LV and RV standard deviation (SD).*



### TDI

*TDI was performed with a Philips Sonos 5500 machine following the American Society of Echocardiography criteria, and asynchrony was defined as the presence of an electromechanical delay (EMD) at any of the left ventricular (LV) segments in a 12-segment model > 20 ms.*





### Synchrony and Entropy

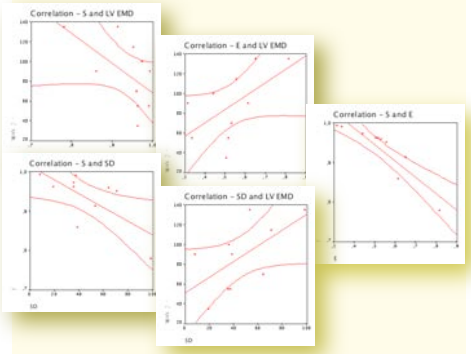
*Each pixel of a RNA is defined by it phase and amplitude, which together define its vector, whereas the amplitude gives the length of the vector.*

*The vector sum of all amplitudes based on the phase angle distribution divided by the scalar sum of the length of all vectors defines S. The degree of disorder in the LV based on the Shannon theory normalized by the number of phases in the LV region defines E.*

*S and E were calculated with a home-made software, considering complete synchrony when S equals 1 and E equals 0, while dyssynchrony is marked by the opposite values.*

## Results

Mean RNA LV ejection fraction was 29,8±9 % and ultrasound ejection fraction was 28± 4% (r=0,85; p=0,004). Phase analysis showed a mean LV SD of 46± 26°. Mean S was 0,93±0,06 and mean E was 0,52±0,14. A statistically significant correlation between S and LV EMD (r=-0,72; p=0,01) was noted, while the correlation between E and EMD did not reach statistical significance (r=0,61; p=0,06). SD significantly correlated with S but not with E (r=-0,69; p=0,02 vs r=0,79; p=0,06). There was no correlation between SD and LV EMD (r=0,56; p=0,09)




## Conclusions

The data from this study demostrate that S and E may represent a promising tool for the evaluation of intra-left ventricular asynchrony and may have greater sensitivity with respect to SD. In fact, S correlates with both classical nuclear and ultrasound parameters of dyssynchrony, whereas no correlation was found between SD and EMD. These data await further validation for routine clinical application.

### Update

*To date, 21 p have been enrolled in the study, and 4 p have completed follow-up. Data under process.*

References: this poster may be downloaded online from http://www.danpont.it/poster.pdf

Badwar Nitish, Viswanathan M, O'Connell JW, DeMarco T, Schreck Carole, Lee ZH, et al. Utility of equilibrium gated radionuclide angiography to guide coronary sinus lead placement in heart failure patients requiring cardiac resynchronization therapy. J Nucl Med 2006;47(5).

Badwar Nitish, O'Connell JW, Viswanathan M, Schreck Carole, Lee BK, Tseng Zian, et al. Novel scintigraphic parameters to assess left ventricular dyssynchrony predict clinical response in heart failure patients requiring cardiac resynchronization therapy. J Nucl Med 2006;47(5):125P.

O'Connell JWilliam, Schreck Carole, Moles Michael, Badwar Nitish, DeMarco Theresa, Olgin Jeffrey, et al. A unique method by which to quantitate synchrony with equilibrium radionuclide angiography. J Nucl Cardiol 2005;12(1071-3581 (Print)):441–50.