

**Impact of LV diastolic
dyssynchrony on diastolic function
in patients with dilated
cardiomyopathy**

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Background

- Systolic dyssynchrony is a relatively common finding in patients with systolic heart failure.
- A number of systolic mechanical indices of asynchrony have been proposed within the left ventricular walls
- In systolic heart failure the prevalence of diastolic dyssynchrony is reported to be as high as systolic dyssynchrony

- Schuster et al JACC 2005

- Diastolic function plays an important role in symptoms and pathophysiology of congestive heart failure. *- Gaasch WH et al. Annu Rev Med 2004*
- Systolic and diastolic asynchrony are not tightly coupled, implying distinct mechanism *- Cheuk-Man Yu et al JACC. 2007*
- However, little is known about whether the existence of diastolic dyssynchrony affects the global LV diastolic function.

Objective

- The present study was conducted to evaluate the impact of diastolic dyssynchrony on LV diastolic dysfunction in patients with systolic HF.

Study population

- 43 DCM patients (M: F= 22:21 , Age: 59 ± 13 yrs, EF= 28 ± 8 %)
- Inclusion Criteria
 - EF < 40%
 - normal coronary angiography finding
- Exclusion Criteria
 - Infiltrative heart disease
 - Heart failure due to valvular disease
 - Atrial fibrillation

Methods

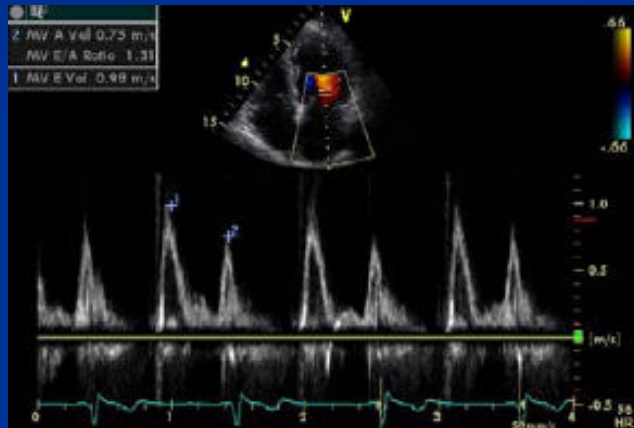
2D Echocardiography

LV end-diastolic (EDV), end-systolic volume (ESV)
by Simpson's disc method

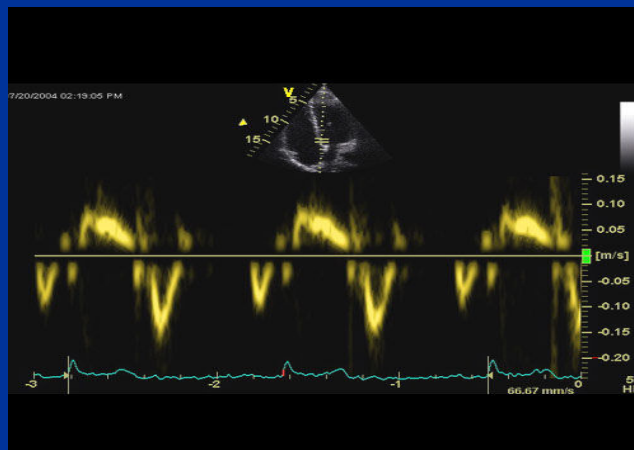
Ejection fraction (EF) : $100 \times (EDV - ESV) / EDV$

2D Echocardiography

Estimation of LV diastolic function

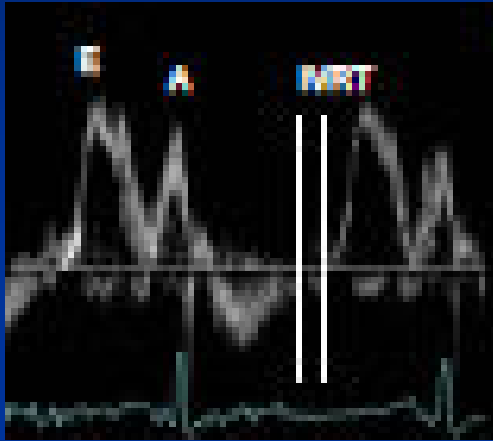


- Peak E velocity of mitral inflow
- Deceleration time of E flow(DT)



- E' velocity; early diastolic velocity of mitral annulus at septal area
- E/E'

2D Echocardiography



- Isovolumetric relaxation time(IVRT)
; time interval from aortic valve close
to the onset of mitral flow

2D Echocardiography

Estimation of LV Diastolic Dyssynchrony (*EchoPAC, GE. Co.*)

Peak Diastolic Times (PDT):

Time from the onset of QRS to peak diastolic E wave

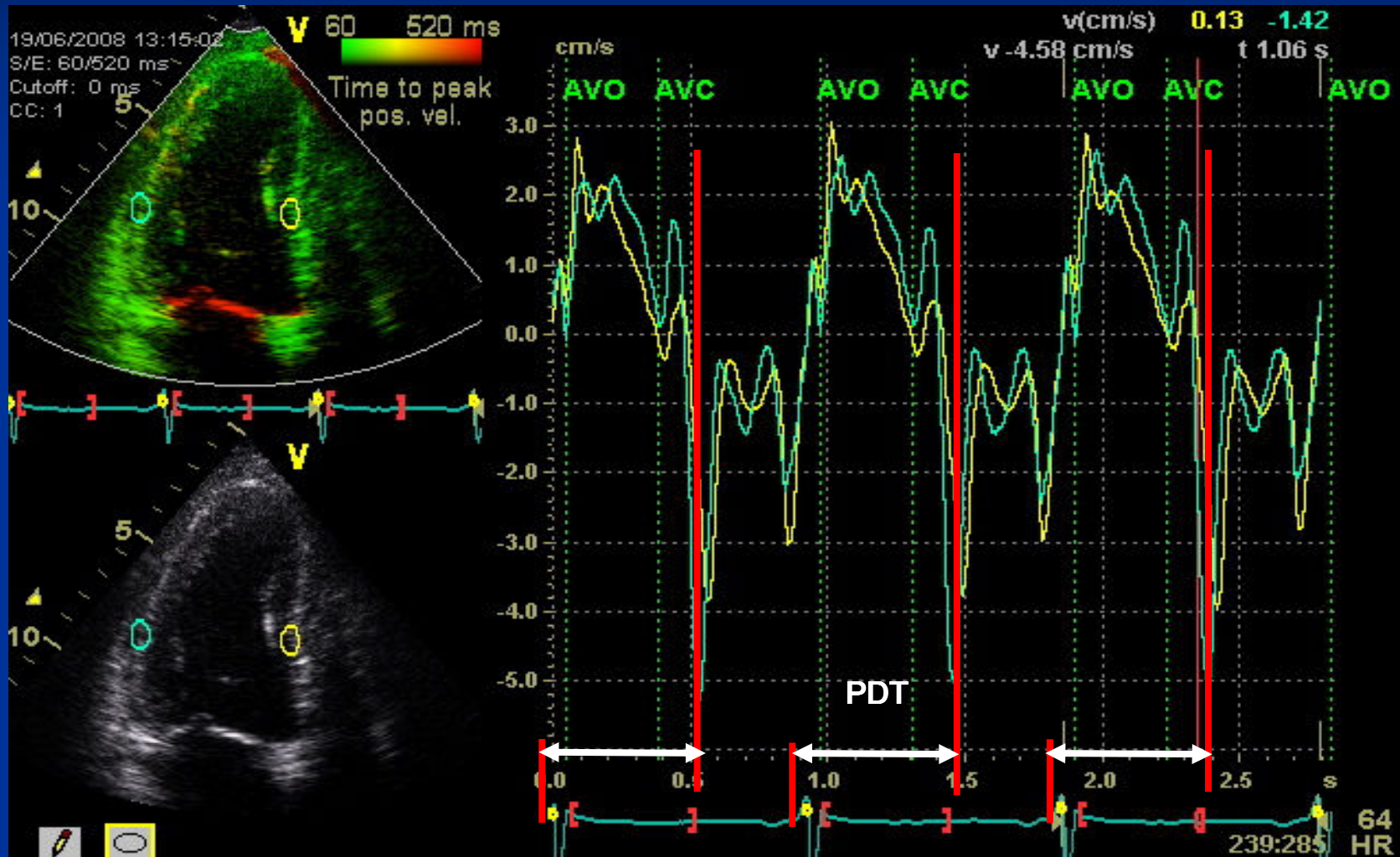
Averaged by 3 PDTs from 3 consecutive heart beats

Diastolic Dyssynchrony Index (DDI): standard deviation of PDTs of eight segments of LV on the apical 2 & 4C planes

DDIs were corrected by the cycle length (CL)

$$\text{cDDI} = \text{DDI} / \sqrt{\text{R-R interval}}$$

Estimation of LV Diastolic Dyssynchrony



Baseline Characteristics

	n=43
Age	59±13
Sex(M/F)	22/21
Diabetes Mellitus(%)	7(16)
Hypertension(%)	6(13)
QRS duration(ms)	112 ± 26
LBBB(%)	4(9)
ACE inhibitor (%)	27(62)
Beta blocker (%)	25(58)

EF; ejection fraction, LBBB; left bundle branch block, LVEDVI; left ventricle end diastolic volume index

Echocardiographic parameters

	n=43
EF(%)	28 ± 9
LVESVI(cm ³ /m)	83.2 ± 45.6
LVEDVI(cm ³ /m)	107.5 ± 43.8
E(cm/sec)	76 ± 27
DT(msec)	229 ± 91
E/E'	22 ± 11
DDI(msec)	37.8 ± 14.5
cDDI	4.7 ± 2.4

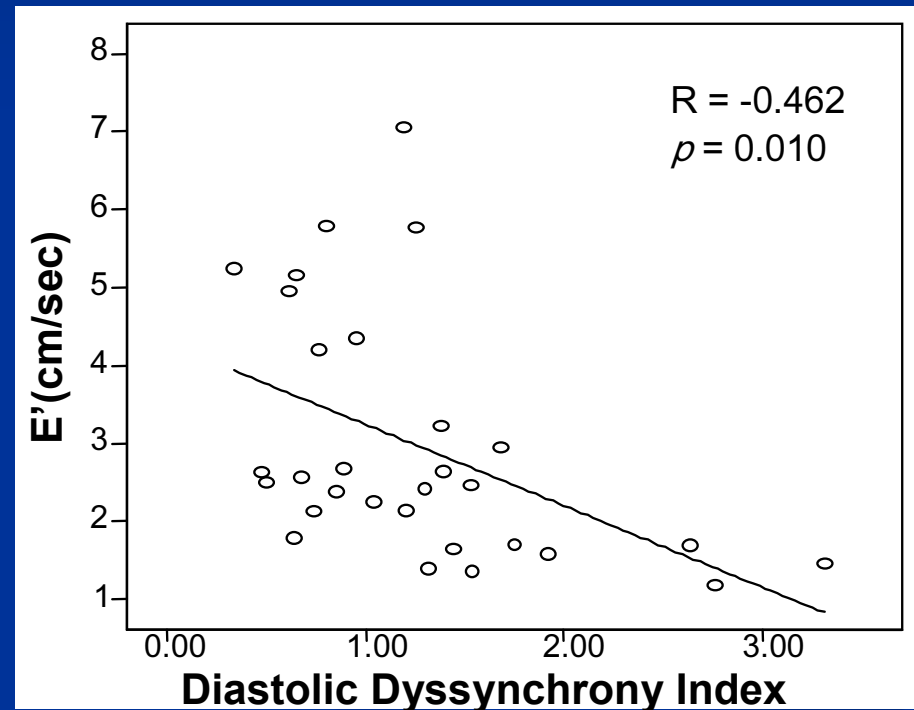
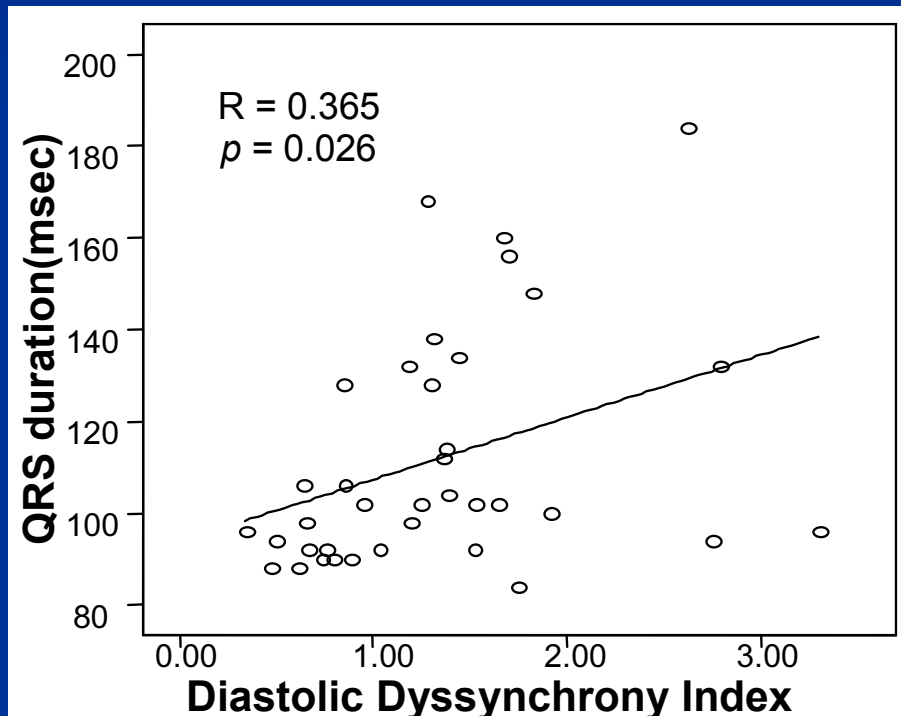
EF; ejection fraction, LVESVI; left ventricle end systolic volume index, LVEDVI; left ventricle end diastolic volume index, DDI; diastolic dyssynchrony index, c; corrected

Univariate relationships of parameters with cDDI

	<i>R</i>	<i>P</i>
LVEDVI	0.044	0.795
EF	-0.006	0.972
DT	-0.189	0.292
IVRT	0.317	0.072
QRS duration	<u>0.365</u>	<u>0.026</u>
E/E'	0.45	0.165
E'	<u>-0.462</u>	<u>0.010</u>
E	0.092	0.604

LVEDVI; Left ventricle end diastolic volume index, EF; ejection fraction, DT; deceleration time, IVRT; isovolumetric relaxation time.

Relationship between DDI and E', QRS duration



Study Limitations

- Relatively small population
- No control group
- Tethering effect
 - Regional systolic velocities may reflect passive motion due to heart motion or tethering by adjacent segments
- TDI method is angle dependent
- DDI was assessed from 8 segments relatively small no of segments, comparing with other studies(12 segments)

Conclusions

- In DCM, electromechanical delay resulting in prolongation of QRS duration probably worsens LV diastolic dyssynchrony
- LV diastolic dyssynchrony may have negative influence on LV diastolic function by decreasing the magnitude of E' velocity.