M-Mode Echocardiography
Is it still Alive?

Itzhak Kronzon, MD, FASE

Research grant: GE; Honoraria: Philips

M-Mode offers better time and image resolution.

Sampling Rate
M-Mode: 1800 / sec
2D: 30 / sec

Disadvantages
1. Single Dimension (depth only)
2. Nonperpendicular orientation (always use 2D guidance).

This pt has a prosthetic MV
Is there MS???

A. Yes
B. No
C. Need to see the MV on 2D
D. Need CW Doppler to tell.
Answer:
B. No

Note the rapid posterior movement of the left atrial wall with rapid left ventricular filling (LA emptying)

Marked LA Dilation in pt with MS

Note absence of early diastolic rapid ventricular filling and short IVR.

Normal MV  MS
M-Mode of RA & LA Myxomas

Back cover of ECHOCARDIOGRAPHY
Feigenbaum, 3rd edition

MV Prolapse

M-Mode in HOCM

ASH / SAM    Mid-systolic AV Closure
Markers of LV Dysfunction

A-C Shoulder ("B-Bump")

Feigenbaum, ECHOCARDIOGRAPHY

ASD with Large L to R Shunt

Note markedly dilated RV and “paradoxical” septal motion

Dyssynchrony by M-Mode -LBBB

Dyssynchrony of >130msec is associated with good CRT response (sensitivity 100%, specificity 63%)
Echo of pt with Endocarditis and Shock

Best Rx is:
1. AVR
2. MVR
3. IABP
4. Can not tell

Echo of pt with Endocarditis and Shock

Answer:
1. AVR

Note premature closure of MV & echogenic mass in LVOT
(Ao veg. Vs. flail Ao cusp)

Differential Dx of Premature MV Closure

A. AR
B. First Degree AV Block
C. High Degree AV Block
D. Blocked APC
E. Atrial Flutter
The most likely physical finding in this pt is:

1. Absent left subclavian pulse
2. High pulse pressure
3. Loud fourth heart sound
4. Apical systolic thrill

Severe Aortic Regurgitation

A patient with this finding will have, most likely, this murmur:

A) Apical Holosystolic
B) Apical Diastolic Rumble
C) Low pitch mid-diastolic at the Rt Base
D) Systolic ejection increased with Valsalva at LSB
The Correct answer is B: Apical Diastolic Rumble

(Austin Flint Murmur)

While fine MV Flutter is indeed a marker of AI
Mid-Diastolic low pitch murmur at the Base is not

Fine MV Fluttering in AR

Commonly seen with AR, but not a marker of severity.

Pulmonic Valve M-Mode

37 y.o. woman with dyspnea and systolic murmur.

Diagnosis?:
A. Valvular PS
B. Pulmonary Htn
C. Constrictive pericarditis
D. Can not tell
ANSWER:

B. Pulmonary Htn

Note the absence of A-dip in spite of NSR
and also the “flying W” pattern
M-Mode in Cardiac Tamponade

Inspiratory Decrease in LV Dimension ("Pulsus Paradoxus")

Note inspiratory decrease in MV excursion

M-Mode in Pulsus Paradoxus

Marked respiratory variation in aortic valve opening

RV diastolic collapse
M-Mode in Constrictive Pericarditis

Note the diastolic Septal “bounce”

NI Mechanical Valve  Stenotic Mechanical MV

Normally acceleration and deceleration are sharp
And rapid. Note blunting of valve excursion on the right.
47 y.o. female with palpitations, Dx?
A. ASD (secundum)
B. Ebstein’s
C. Intraaortic Balloon
D. Arrhythmogenic RV Dysplasia

MV in Atrial Flutter with variable block

What is the Dx?
A. AV Diss’n
B. Atrial Diss’n
C. AV Block
D. All of the above
What is the Dx?

A. AV Diss’n
B. Atrial Diss’n
C. AV Block
D. All of the above

ANSWER: D. All of the above.

While the EKG shows AV diss’n and AV block, the MV echo suggests timed LA contraction. The atria are therefore dissociated.

M-Mode in WPW Type A

Feigenbaum

Note pre-excitation of the posterior wall

IVC plethora

Estimated IVC pressure 20mmHg
M-mode Color Doppler of LV Filling
Normal Slope ≥ 45 cm/sec  Garcia 1996

M-mode Color flow propagation

1. Better understanding of LA hemodynamics
2. Better estimation of time intervals
3. Simple evaluation of dyssynchrony
4. Motion patterns of normal and abnormal structures
5. Identify high frequency motion
6. Evaluation of PHT even in the absence of TR/PR
7. Insight into mechanism of paradoxical pulse and tamponade
8. Better evaluation of prosthetic valve function
9. Diagnose Arrhythmias (sometimes better than EKG…)
10. Color M-mode for timing and flow propagation

VSD with R to L shunt
Note that after contrast appears in the RV, it is seen in the LV, sparing the MV orifice.
Markedly elevated RA pressure (> 20 mm Hg)

Note: 1. Dilated IVC
2. Lack of respiratory variation

M-Mode Contrast Echo (IV Saline Injection)
Tajik & Seward, 1979

What is the Dx?
A. VSD, R to L shunt
B. VSD, L to R shunt
C. ASD, L to R shunt
D. ASD, R to L shunt

Injection to rt hand vein

M-Mode Contrast Echo (IV Saline Injection)
Tajik & Seward, 1977

ANSWER:
D. ASD, R to L shunt

Note that when the contrast appears in the RV, it appears in the MV orifice.
What is the most likely presentation of this pt:
A - Round mass in left lung known for 20 years
B - New LBBB
C - CABG 7 years ago
D - Loud holosystolic murmur along the LSB

Comprehensive Hemodynamic Evaluation by Doppler Echocardiography
Itzhak Kronzon, MD

The Simplified Bernoulli Equation

$\Delta P = 4V^2$

$P =$ pressure (mm Hg)
$V =$ velocity (m/sec)

Liv Hatle
### Assessing Hemodynamics

**RA pressure (using IVC size)**

**Evaluation of Right Atrial Pressure**

<table>
<thead>
<tr>
<th>IVC (cm)</th>
<th>Δ with resp (%)</th>
<th>RA pressure (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1.5</td>
<td>Collapse</td>
<td>0-5</td>
</tr>
<tr>
<td>Nl (1.5-2.5)</td>
<td>↓ &gt;50</td>
<td>5-10</td>
</tr>
<tr>
<td>Nl</td>
<td>↓ &lt;50</td>
<td>11-15</td>
</tr>
<tr>
<td>&gt;2.5</td>
<td>↓ &lt;50</td>
<td>16-20</td>
</tr>
<tr>
<td>&gt;2.5</td>
<td>No change</td>
<td>&gt;20</td>
</tr>
</tbody>
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