Emergency Echo, Emergency Setting, “ABCD” Approach

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Emergency Echocardiography

- Why ECHO in cardiac emergencies?
- Emergency setting
- Emergency clinical presentations
- Simple and comprehensive answers
- Medicolegal issues
- “ABCD” approach
Why Echo in Cardiac Emergencies?

- Cardiologists consider ECHO as the single most valuable technique to assess unstable CV patient

**Availability**
- noninvasive
- harmless
- portable
- inexpensive

**Accuracy**
- structure
- function
- hemodynamics
“The most important feature of echo machine”

Arthur Weyman

ER
Ward
ICU
CCU
OR
Cath Lab
TTE

New murmur, fever
TEE

Acute Severe Dyspnea
Contrast Echo

LV Opacification  Myocardial perfusion

Courtesy of R. Senior
Stress Echo

Dip-Echo

Courtesy of MJ Andrade
Emergency Echocardiography

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Emergency Echo Setting

- Stressful environment
- Critically ill
- Time constrain
- Poor images (often)
- Limited consultation time with others
- Critical decisions (surgery, Th)
- Medical errors are likely to occur!
Referrals for Immediate Interventions

- Acute coronary syndromes
- Cardiogenic shock
- Ao dissection
- Acute AR
- Cardiac tamponade
- Acute MR
- Post MI PM rupture
- Post MI LV free wall rupture
- Post MI VSD
- Prosthetic valve thrombosis
Relative Incidence

Impact of pretest likelihood of the disease
(Bayesian Theory)

Different results in:
- ER
- CCU
Emergency Echocardiography

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Emergency Clinical Presentations

Referrals for the Emergency Echo

1. Acute chest pain
2. Acute dyspnea
3. Hemodynamic instability (acute HF, shock)
4. New murmur
5. Syncope (CVI), source of emboli
6. Chest trauma
7. Cardiac arrest/CPR
### Major Causes of Cardiac/Cardiac-like Emergencies and their Common Initial Clinical Presentations

<table>
<thead>
<tr>
<th>ACS</th>
<th>AoD</th>
<th>PE</th>
<th>P</th>
<th>Ptx</th>
<th>ADHF</th>
<th>T</th>
<th>AVR/PVD</th>
</tr>
</thead>
</table>

- **Serious**
- **Lifethreatening if untreated**
- **Prompt echo detection/assessment**

| Cardiac arrest/CPR | ++++ | + | +++ | + | + | + | +++ | + |

- **Acute chest pain**
- **Acute dyspnea**
- **Hemodynamic instability/Shock**
- **New murmur**
- **Cardiac sources of embolism/Syncope**
- **Chest trauma**
- **Cardiac arrest/CPR**
## Major Causes of Cardiac/Cardiac-like Emergencies and their Common Initial Clinical Presentations

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<tr>
<td>Acute dyspnea</td>
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<td>Hemodynamic instability/Shock</td>
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Simple
Chest Pain

Nondiagnostic ECG in the ER
Chest pain

... 2 min after!
Chest pain

... 2 min after!

Courtesy of V. Cvorovic
Comprehensive
Severe Acute Dyspnea
Acutely Decompensated HF
ADHF:
Comprehensive Echo Evaluation

1. LV systolic function

2. Estimation of RV systolic pressure
Estimation of RV Systolic Pressure

TR jet velocity 3.38 m/s
Estimated RVSP 53 mmHg
ADHF: Comprehensive Echo Evaluation

1. LV systolic function
2. Estimation of RV systolic pressure
3. Cardiac output
Estimation of Cardiac Output

\[ SV = CSA_{\text{LVOT}} \times VTI_{\text{LVOT}} \]

\[ CO = SV \times HR \]
ADHF: Comprehensive Echo Evaluation

1. LV systolic function
2. Estimation of RV systolic pressure
3. Cardiac output
4. Estimation of LV filling pressure
Restrictive LV Filling Pattern

Transmitral Flow

E/A = 2.5

DT = 140 ms
Estimation of LV Filling Pressure

Transmitral Flow

100 cm/s

Mitral annular velocity (DTI)

5 cm/s

\[
\frac{E}{E'} = \frac{100}{5} = 20
\]
Predicting LV Filling Pressure by E/E’

- Simple
- Doable
- Essential information

\[ \begin{align*}
\text{E/E’ ratio} & > 15 \\
\uparrow \text{LA pressure} \\
\text{E/E’ ratio} & < 8 \\
\downarrow \text{LA pressure} \\
\text{E/E’ ratio} & \text{ 8-15} \\
\text{useless}
\end{align*} \]

Ommen SR et al, Circ 2000
Systolic Fraction of the Pulmonary Venous Flow
Effects of Increased Mean LAP on Pulmonary Venous Pattern

mean LAP=9 mmHg

mean LAP=15 mmHg

Kuecherer HF et al, Circ 1990
Systolic Fraction of the Pulmonary Venous Flow

\[ SD(\%) = 44\% \]
Estimation of Mean LAP by Systolic Fraction of the Pulmonary Venous Flow

\[
\Delta \text{Mean LAP (mm Hg)} = -0.38 - 0.24 \times \Delta \text{Systolic Fraction (\%)}
\]

\[y = -0.38 - 0.24x, \quad r = -0.78, \quad n=42, \quad \text{SEE} = 3.9 \text{ mm Hg}\]

\(< 55\%\)

Sn 91%, Sp 87% for predicting mean LAP ≥ 15 mmHg

Kuecherer HF et al, Circ 1990
ADHF: Comprehensive Echo Evaluation

1. LV systolic function
2. Estimation of RV systolic pressure
3. Cardiac output
4. Estimation of LV filling pressure
5. Estimation of dP/dT
Noninvasive Estimation of dP/dT

Good
> 1200 mmHg/s

Poor
< 1000 mmHg/s

939.5 mmHg/s

1 m/s

3 m/s
ADHF: Comprehensive Echo Evaluation

1. LV systolic function
2. Estimation of RV systolic pressure
3. Cardiac output
4. Estimation of LV filling pressure
5. Estimation of dP/dT
6. Extravascular lung water
Ultrasound “Lung Comets” in ADHF

Courtesy of L. Gargani
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Important Facts

- Over 225,000 people die from medical malpractice related injuries in a single year.

- Nearly 50% of these are from emergency room errors.
Emergency Echo: Medicolegal Issues

- Should **not** be ignored!
- Cases: documented, stored (DICOM), and retrieveable
- Adequate machine used
- **Reports:** approved/signed by the individual with adequate formal education
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Emergency Echo

How to avoid bad scenarios?

“ABCD” approach
Take Home Message

Emergency Echocardiography

ABCD approach

Awareness

Be Suspicious

Comprehensiveness

Double R *

* Record/Review

Fight against routine

- Think beyond apparent explanations
- Referral Dg may be misleading
- Never trust, confirm

Do as complete exam as suitable

Team work
Take Home Message
Emergency Echo

ECHO in the emergency setting is highly demanding diagnostic procedure and should not be attempted by inexperienced without supervision!
Emergency Echo

- Only simple to apply, not to perform!
- **Perspective**: increased use of mini echo machines instead of the "stethoscope" by non-cardiologist or inadequately trained cardiologist
- **Saving lives vs. disastrous errors** in the emergency setting
- **Key issue**: **Education / Curriculum**!
EAE Recommendations on Emergency Echocardiography

...spring 2011!