Pitfalls in emergencies

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Pitfalls victims?

**WHO**: all of us

**WHEN**: - Learning curve!
- When we hurry!

**WHICH conditions**:
- Poor devices /pts.windows
- Arrhythmias
- Extreme ages (children, old pts.)
- Complex diseases/procedures
We love what we have…
WHY:

I. Technical errors during exam

I DON’T SEE!

II. Choice of irrelevant parameters

I LOOK IN THE WRONG DIRECTION!

III. Errors in interpreting results

‘ I DON’T UNDERSTAND!

EAE recommendations for training, competence, and quality improvement.

*European Journal of Echocardiography (2009) 10, 893–905*
Let’s look closer!
Technical errors ....
A. Poor image
How to avoid

- Change frequency!
- Use harmonics!
How to avoid

- Use respiratory cycle variations /apnea!
- Change patient’s position!
B. Inadequate imaging (2D)

A. Bad transducer position

B. Wrong M-mode cut
How to avoid

Go to the spine! ("il appice di Pordenone")

Short axis before M mode measurements!
Inadequate imaging (Doppler)

Best Doppler signal..

..NOT necessarily from the ideal 2D imaging point
The clearest signal ..

...could be not the good one..
Inadequate imaging (Doppler)

PW: mitral inflow

1. Bad sample volume position
   - valve/annulus artifacts
   - maximal velocity underevaluated (modified E/A)

2. Too large sample volume
   - wide velocity spectrum

3. Gain excess
   - may alter time and velocity measurements

4. Inadequate filters
   - wall/valve artifacts
   - falsely “reduced” durations
Inadequate imaging (Doppler)

5. Inadequate Doppler beam direction
   - maximal velocity underevaluated

6. Sweep
   - greater error probability (duration/PHT)

7. Number of cardiac cycles measured
   - errors: pts in atrial fibrillation
8. Not using provocative maneuvers
   - Valsalva
   - respiratory

9. Ignoring audio signal

10. Lack of recording measurements
Inadequate choice... of relevant parameters
The chosen parameter - correctly calculated – does not really express, in that context, the severity of the condition.

-- LV/Ao gradient in aortic stenosis with low LV EF

-- color (semi quantitative) assessment of AR in acute AR
low LV EF

No endd. aortic turbulence ..

...but diastolic mitral regurge and brisk aortic PHT
In spite of correctly applying the technique, there are major (nonavoidable) disturbing factors

Using PAT formula in proximal pulmonary emboli

Eur Respir J 1999; 13: 616 – 21

- early return of the reflected pressure wave interfering with RV ejection.

- severely impaired RV function
Using *PAT formula* for PAP assessment in very severe PHT

<table>
<thead>
<tr>
<th>Pressure \medie \cateterism</th>
<th>TAP (met.A)</th>
<th>Gradient diastolic max AP/VD (met B.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-45 mm (n:6)</td>
<td>-3.6 mm (-14, +8)</td>
<td>-12.3 mm (-21, -8)</td>
</tr>
<tr>
<td>45-50 mm (n:10)</td>
<td>-4.7 mm (-16, +3)</td>
<td>-11.9 mm (-22, -3)</td>
</tr>
<tr>
<td>&gt;50 mm (n:6)</td>
<td>-9.9 mm (-21, -5)</td>
<td>-16.4 mm (-29, -8)</td>
</tr>
</tbody>
</table>
III. Errors in interpreting results
Misunderstanding results

1. Incorrect recognition of structures / waves / flows
   - right heart structures
   - right heart flows
   - left heart structures
   - left heart flows

2. Ignoring normal values range
   Don’t be ashamed to look in a manual!

3. Not using correction for:
   - BMI
   - cardiac frequency
   - position: - Coanda effect

ASIA and Chiari network (no clots!)
Catheters, electrodes

Left main stent
Not tricuspid regurgitation!
( but LV-RA shunt! )

No trombus!
( RV tumor )
Coanda effect: color underestimation of regurge

No vegetation!
Ruptured papilary muscle!
4. Ignoring the haemodynamic context:

**LV dysfunction:**
- E/A pseudonormalisation
- different significance of EF in severe mitral regurge

**Intracavitary / arterial pressures**
- HT: increased color area of mitral regurge

**Associated Lesions:**
- transmitral gradient in associated regurge
- gradient in multiple stenosis (initial velocity high! : extended Bernoulli)
Table 38-1. Normal Values of Doppler Parameters in Apparently Normal Prosthetic Valves

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Velocity (m/sec) $v_{\text{max}}$</th>
<th>Gradient (mm Hg) $\Delta P_{\text{max}}$</th>
<th>$\Delta P_{\text{mean}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mitral Position</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starr-Edwards</td>
<td>$1.9 \pm 0.4$</td>
<td>$14.6 \pm 5.5$</td>
<td>$4.6 \pm 2.4$</td>
</tr>
<tr>
<td>(ball-in-cage)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Jude Medical</td>
<td>$1.6 \pm 0.3$</td>
<td>$10.0 \pm 3.6$</td>
<td>$3.5 \pm 1.3$</td>
</tr>
<tr>
<td>(bileaflet)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bjork-Shiley</td>
<td>$1.6 \pm 0.3$</td>
<td>$10.7 \pm 2.7$</td>
<td>$2.9 \pm 1.6$</td>
</tr>
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<td>(tilting disc)</td>
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<tr>
<td>Carpentier-Edwards</td>
<td>$1.8 \pm 0.2$</td>
<td>$12.5 \pm 3.6$</td>
<td>$6.5 \pm 2.1$</td>
</tr>
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<td>(porcine bioprosthesis)</td>
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<tr>
<td>Hancock</td>
<td>$1.5 \pm 0.3$</td>
<td>$9.7 \pm 3.2$</td>
<td>$4.3 \pm 2.1$</td>
</tr>
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<td><strong>Aortic Position</strong></td>
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<tr>
<td>Starr-Edwards</td>
<td>$3.2 \pm 0.6$</td>
<td>$38.6 \pm 11.7$</td>
<td>$23.0 \pm 8.8$</td>
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<tr>
<td>St. Jude Medical</td>
<td>$2.4 \pm 0.3$</td>
<td>$25.5 \pm 5.1$</td>
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<td><strong>Tricuspid Position (Case Reports)</strong></td>
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<td>Bjork-Shiley</td>
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<td>$10.2$</td>
<td>$5$</td>
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<td>(tilting disc)</td>
<td></td>
<td></td>
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<tr>
<td>Porcine bioprosthesis</td>
<td>$1.3 \pm 0.3$</td>
<td>$7 \pm 2$</td>
<td>$3 \pm 2$</td>
</tr>
</tbody>
</table>

(Data summarized from refs. 18, 55, 111, and 112.)

Ignoring normal values range
Misunderstanding results

5. Ignoring general biological context
   Age   Elder pts: impaired relaxation

   Hyperkinetic Syndrome
      - Pregnancy
      - Anemia
      - Hyperthyroidia

6. Recent therapeutic procedures
   - Diuretics
   - SR post electric conversion: absent or <“a”
   - Coronarography / stenting
Searching for …
CONCLUSIONS

TO AVOID PITFALLS we need:

• Good theoretical knowledge of US physics
• Solid practical training
• Clinical integration of data
• Patience