Standard echo examination

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Cardiff University
Before starting the examination ..

- check the patient’s details
- understand the clinical questions
- record patient’s height and weight
- record / document arterial blood pressure
- allocate sufficient time (30-60 minutes)
- use good & well maintained echo machine
A 12-year old girl with a murmur

Echocardiogram performed 16 months previously
Performance of ultrasonic transducers
Sensitivity of individual elements

Performance of a normally functioning transducer

Testing of the transducer used in the clinical study

Sonora FirstCall Test
# Testing of ultrasonic transducers in Sweden

676 transducers in routine clinical use in 32 hospitals

<table>
<thead>
<tr>
<th>Transducer defect</th>
<th>Number</th>
<th>Frequency %</th>
<th>95% CI %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delamination</td>
<td>179</td>
<td>26.5</td>
<td>23.5 - 29.8</td>
</tr>
<tr>
<td>Break in the cable</td>
<td>57</td>
<td>8.4</td>
<td>6.3 - 10.5</td>
</tr>
<tr>
<td>Short circuit</td>
<td>23</td>
<td>3.4</td>
<td>2.0 - 4.8</td>
</tr>
<tr>
<td>Weak elements</td>
<td>6</td>
<td>0.9</td>
<td>0.2 - 1.6</td>
</tr>
<tr>
<td>Dead elements</td>
<td>4</td>
<td>0.6</td>
<td>0 - 1.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>269</strong></td>
<td><strong>39.8</strong></td>
<td>—</td>
</tr>
</tbody>
</table>
How to set up the patient

- steep left lateral (decubitus) position
- unrestricted access to the apex
- patient comfortable
- good-quality ECG (large R wave amplitude)
- operator comfortable (straight back)
How to set up the patient
Use a **systematic** approach

- **Structure / morphology**
  2D, (3D)
  M-mode, anatomical M-mode

- **Function / flow**
  M-mode, colour M-mode
  Colour flow mapping
  Myocardial velocity imaging

- **Haemodynamics**
  Continuous wave
  Pulsed Doppler *with sound*
Use anatomical M-mode for good alignment.

Don’t use Teichholz!
Colour M mode: flow propagation velocity

20.9 cm/s
Colour M-Mode (MQ)

High spatial & temporal resolution for resolving flow events
Use *every view, every time*

- Parasternal long axis
  - RV inflow & outflow
- Parasternal short axis
  - AV, basal, mid, apical LV ..
- Apical views
  - A4C, A2C, APLAX ..
- Subcostal views
- Suprasternal views

and SCAN the whole structure!
Try to avoid apical foreshortening

Ratio
1.6
2.1

Sphericity
62%
47%
Estimation of right atrial pressure
Change in diameter of inferior caval vein

Inspiration

Sniff
Non-invasive estimation of right atrial pressure

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>RA vol min &gt;30 cm³</td>
<td>44</td>
<td>90</td>
</tr>
<tr>
<td>RAEF &lt;40%</td>
<td>56</td>
<td>87</td>
</tr>
<tr>
<td>IVC collapse &lt;50%</td>
<td>72</td>
<td>76</td>
</tr>
<tr>
<td>Tricuspid E/A ratio &lt;1.1</td>
<td>66</td>
<td>92</td>
</tr>
<tr>
<td>Hepatic vein SFF &lt;55%</td>
<td>86</td>
<td>90</td>
</tr>
</tbody>
</table>

Nagueh SF et al, Circulation 1996; 93: 1160-9
Diagnosis of tricuspid regurgitation

Color Doppler

CW Doppler

Hepatic Vein Flow

Mild TR

Severe TR
Suprasternal imaging of aorta

34yr ♂, bicuspid aortic valve
Recording and reporting

• **Store digital images and loops**
  - including multiple beats
• **Always review the study when reporting**
• **Measure, don’t guess ..**
  - ejection fraction *and* LV volumes
• **Index for body surface area**
• **Compare with age-derived normal values**
• **Answer the clinical question ..**
ASE 16 segment model – now 17
Echocardiographic segmentation

- RV
- LV
- A4C
- A2C
- APLAX
- MAS
- MS
- MI
- ML
- MP
- MA
The normal heart is a piston pump ..

.. so analyse & report long-axis function, and not just global & radial function
M aged 42 y, AVR for dissection with AR
Don’t make diastole too simple
– remember normal patterns of ageing
– assess both relaxation & stiffness/filling
Relaxation

- E/A ratio, E deceleration time
- Isovolumic relaxation time
- Flow propagation velocity
- Myocardial Ve, Se, SRe

Compliance

- Short duration A wave
- Increased PV reversed flow
- E/e’ ratio (E/a)
- Left atrial volume
A 24-year-old man referred with a “chest infection”
Be critical and avoid fashion ...

Normal cardiac morphogenesis

Courtesy of Dr Tim Mohun
Normal regional variations in trabeculations

Kohli SK et al, Eur Heart J 2008; 29: 89-95
Improving quality & clinical outcomes

• Base practice on evidence & clinical impact
• Implement quality-improvement programmes
• Use echo with other imaging modalities

*Not just better pictures
but more information about function*