Looking Outside the Box: Incidental Extracardiac Finding in Echo

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Case 1

- 17 year old boy presented to the ER:
  - Left sided chest pain aggravated with breathing
  - Low back pain
  - Shortness of breath
  - Fatigue
  - Had felt febrile on and off since the past few months.

- General examination:
  - Thin, pale boy, mildly tachypneic, afebrile
  - Tachycardic with HR of 125
  - Blood pressure 93/60 mmHg
Echo-guided Pericardiocentesis
Two days later in the ICU
- Patient is more distressed
- Tachypnic 25/min
- Tachycardic HR 135bpm
- BP 92/50 mmHg
Echo Report:
• Large pericardial effusion
• Large hematoma compressing the RV
• Diffuse Large B-cell Lymphoma stage IV
• Started on chemotherapy.
• Regression of tumor size after few weeks.

Missed clue: Wide superior mediastinum on chest X ray
Case 2

- 15 year old girl diagnosed as Hodgkin’s lymphoma (nodular sclerosing)
- Planned for chemotherapy
- Echocardiography was requested
- Report: positive findings
  - Small pericardial effusion
  - Small PDA
  - No mention of ECF in report
• The patient had successful treatment
• Currently in remission
Case 3

• 43 male known case of metastatic colon cancer
• Admitted for chemotherapy
• Echocardiography requested prior to start of chemotherapy
• No significant cardiac pathology noted
• Subcostal images showed liver abnormality
• Report read:
  • ? Liver masses-suggest CT abdomen
Case 4

- 78 year old lady
- Known case of metastatic breast cancer on chemotherapy
- Patient has moderate aortic stenosis
- Subcostal views showed abnormality
- Report read:
  - ?liver masses ? mets
Case 5

- 47 year old male diabetic and hypertensive
- Focal segmental glomerulonephritis
- Chronic kidney disease
- Hyperlipidemia
- Raised liver enzymes and. Liver biopsy showed non-specific fatty infiltration of liver
- MRI liver reported normal liver morphology and signal intensity and no focal hepatic lesions
• Echocardiography was requested because of chest pain
• No significant cardiac pathology
• Subcostal views showed ECF
• Report read:
  • Abnormal liver texture need U/S

• Ultrasound abdomen: Diffuse hepatic steatosis (fatty liver)
Case 6

• 53 Hypertensive male not on any medication
• Admitted as a case of CVA
• CT brain showed intra-cerebral hemorrhage.
• Echocardiogram requested as initial work up

• Echo report:
  • Severe LV hypertrophy
  • Ejection fraction =45-50%
  • Mild to moderate mitral regurgitation
Extracardiac findings
Incidental ECF Abdominal Aorta Dissection
TTE report:
- There is dissection flap across entire seen portion of the abdominal aorta, there is flap seen in the descending aorta just distal to the subclavian artery. No flap seen in the ascending aorta

CT report after TTE:
- Extensive dissection involving the thoracoabdominal aorta starting just beyond the left subclavian artery extending downward all the way down to the left renal artery
Case 7

- 78 male HTN, DM and known case of ischemic heart disease
- Post PCI to LAD
- TTE: EF 25% moderately severe mitral regurgitation
- PA systolic pressure 55-60 mmHg
- TEE requested to assess the severity of mitral regurgitation.
- TEE reported severe MR and additional ECF:
  - Severe atheromatous disease of descending aorta
  - Aortic dissection.
Case 8

- 56 male complains of chest pain and shortness of breath
- Diagnosed as mitral valve prolapse with severe mitral regurgitation and impaired LV function EF=40%
- TEE was requested for assessment of mitral valve
Descending Aorta Imaging
TEE Report Extracardiac finding

- Aortic dissection descending aorta, no entry point seen, no flap in ascending aorta. No evident thrombus
- CT scan is needed for full assessment

CT Report

- There is congenital anomaly consisting of hemiazygous continuation of left sided IVC
- Left IVC coursing superiorly lateral to the descending aorta up to the junction between left subclavian and left internal jugular vein
Left hemiazygous continuation of left IVC
Pulmonary Artery Thrombus

IVC Thrombus
Case 9
Extracardiac Findings in Echo, Where do we Stand?

- Echocardiography is the most widely used imaging modality for assessing cardiovascular anatomy and physiology.
- > 20 million echocardiographic studies are performed annually in USA.
- There is dilemma on how to report the incidental extracardiac findings.
- The standardized echo report (as per ASE recommendations) does not include reporting of incidental extracardiac findings.
- There are no training guidelines for diagnosing and reporting extracardiac findings.
- Few data regarding extracardiac findings exist.
Definition of ECF

- Definition is not established. Most would agree about:
  - Pleural effusion
  - Ascites
  - Liver abnormality
  - Lung or mediastinal mass
  - Abdominal aorta abnormalities
  - Hiatus hernia
  - Many argue that descending aortic abnormality in TEE is not extracardiac
  - Ascending aorta abnormalities are not considered ECF
- Experienced and skilled physicians can identify extracardiac findings especially if they are trained in non cardiac pathology
- If one is not trained to see and abnormality, the detection sensitivity will be low.
What is the Incidence of ECF by Echocardiography?

- Myocardial perfusion imaging: 1-4%
- Cardiac CT and CMR: 10-60% in different studies
- Echocardiography: Not much data is available
  - Khosa et.al: 7.5%
  - AlKhouli et.al: 4.4 %
Prevalence of Non-Cardiac Pathology on Clinical Transthoracic Echocardiography. Khosa et.al 2008

• Subcostal images from 1008 TTE studies reported by experienced sonographers (level 2 or level 3) were analyzed by 2 radiologists separately.

• **Classification of ECF:**
  
  • **Benign:** Do not alter patient management or require follow up assessment
    • Simple hepatic cysts
    • Hemangioma
    • Cholelithiasis.
  
  • **Intermediate:** Might require some form of follow-up assessment
    • Pleural effusions
    • Ascites
    • Cholecystitis
  
  • **Worrisome:** Potentially have major impact on patient management
    • Metastasis
    • Venous thrombosis.
Patients, n= 922  
TTEs, n= 1008  
Inpatient TTEs, n=443  
Outpatients, n=565  
ECFs, n=77 (7.5%)

- Benign: 20 (26%)  
  Previously known: 13 (65%)

- Intermediate: 52 (67%)  
  Previously known: 35 (67%)

- Worrisome: 5 (7%)  
  Previously known: 3 (60%)
<table>
<thead>
<tr>
<th>Category</th>
<th>Inpatient (n = 47 [61%])</th>
<th>Outpatient (n = 30 [39%])</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Benign (n = 20 [26%])</strong></td>
<td>Hepatic cyst (7)</td>
<td>Hepatic cyst (8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hemangioma (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uncomplicated cholelithiasis (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Renal collecting system fullness (1)</td>
</tr>
<tr>
<td><strong>Indeterminate (n = 52 [67%])</strong></td>
<td>Ascites (16)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pleural effusion (14)</td>
<td>Ascites (5)</td>
</tr>
<tr>
<td></td>
<td>Cholecystitis (4)</td>
<td>Pleural effusion (5)</td>
</tr>
<tr>
<td></td>
<td>Choledocolithiasis (1)</td>
<td>Cholecystitis (1)</td>
</tr>
<tr>
<td></td>
<td>Indeterminate hepatic cyst (3)</td>
<td>Dilated gallbladder with polyp (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Indeterminate hepatic cyst (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Calcified adrenal gland (1)</td>
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<tr>
<td><strong>Worrisome (n = 5 [7%])</strong></td>
<td>IVC filling defect (1)</td>
<td>IVC stenosis (1)</td>
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<tr>
<td></td>
<td>Liver metastasis (1)</td>
<td>Liver involvement by sarcoid (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Portal vein thrombus (1)</td>
</tr>
</tbody>
</table>
Conclusion:

- The incidence of ECF on TTE imaging is much smaller than other modalities:
  - Cardiac CT: 23%
  - CMR: 43%
- The incidence of potentially management altering findings was only 3.8%. Majority of them were previously known
- None of those not previously known had an impact on patient outcomes after downstream analysis.
- Analysis of additional views of a subset of 300 patients showed additional ECF in 6 (2%) patients: 4 pleural effusions and two hernias. All were non management altering.
ECF on Routine Echocardiographic Examinations. Alkhoulì et.al 2014

- 41,067 echocardiographic studies both TTE and TEE were screened
- ECFs were defined as findings in:
  - Liver
  - Lung and pleura
  - Abdomen
  - Mediastinum
  - Vena cava
  - Pulmonary artery
  - Descending to aorta
- A comprehensive list of keywords (that experienced echoacardiographers use to describe ECFs) was developed and used to search all the echocardiographic reports in the database.
- The list of keywords captured ECFs in 98% of patients
Sensitivity analysis of 350 TTE images by 2 experienced readers

<table>
<thead>
<tr>
<th></th>
<th>Reader 1</th>
<th>Reader 2</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total studies reviewed</td>
<td>175</td>
<td>175</td>
<td>350</td>
</tr>
<tr>
<td>Agreed with positive ECF</td>
<td>23</td>
<td>18</td>
<td>41/55 (75%)</td>
</tr>
<tr>
<td>Agreed with negative ECF</td>
<td>141</td>
<td>139</td>
<td>280/295 (95%)</td>
</tr>
<tr>
<td>Disagreed with positive ECF</td>
<td>5</td>
<td>9</td>
<td>14/55 (25%)</td>
</tr>
<tr>
<td>Disagreed with negative ECF</td>
<td>6</td>
<td>8</td>
<td>15/295 (5%)</td>
</tr>
</tbody>
</table>
Total incidence of ECFs was 4.4%

<table>
<thead>
<tr>
<th>ECF</th>
<th>TTE (n = 39,269)</th>
<th>TEE (n = 1,798)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleural effusion</td>
<td>1,032 (2.6%)</td>
<td>45 (2.5%)</td>
</tr>
<tr>
<td>Lung or mediastinal mass</td>
<td>4 (&lt;0.1%)</td>
<td>1 (&lt;0.1%)</td>
</tr>
<tr>
<td>Ascites</td>
<td>129 (0.3%)</td>
<td>3 (0.2%)</td>
</tr>
<tr>
<td>Liver abnormalities</td>
<td>41 (0.1%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Hernia</td>
<td>13 (&lt;0.1%)</td>
<td>1 (&lt;0.1%)</td>
</tr>
<tr>
<td>DA dilatation</td>
<td>141 (0.4%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>DA thrombus or ulcer</td>
<td>3 (&lt;0.1%)</td>
<td>34 (2%)</td>
</tr>
<tr>
<td>DA severe atheroma</td>
<td>4 (&lt;0.1%)</td>
<td>107 (6%)</td>
</tr>
<tr>
<td>Mild to moderate DA atheroma</td>
<td>19 (&lt;0.1%)</td>
<td>206 (11.5%)</td>
</tr>
<tr>
<td>IVC thrombosis</td>
<td>10 (&lt;0.1%)</td>
<td>2 (0.1%)</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>2 (0.1%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Total</td>
<td>1398 (3.5%)</td>
<td>399 (22.2%)</td>
</tr>
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</table>
Clinical follow up review was done up to 17.8 months

<table>
<thead>
<tr>
<th>ECF</th>
<th>Incidence</th>
<th>TTE</th>
<th>Inpatient</th>
<th>Follow-up available</th>
<th>Follow-up studies</th>
<th>Echocardiography led to new diagnosis requiring further management</th>
</tr>
</thead>
<tbody>
<tr>
<td>DA dilatation</td>
<td>141</td>
<td>100%</td>
<td>117 (83%)</td>
<td>105 (74%)</td>
<td>71</td>
<td>22 (31%)</td>
</tr>
<tr>
<td>Ascites</td>
<td>132</td>
<td>97%</td>
<td>107 (81%)</td>
<td>114 (86%)</td>
<td>20</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Liver abnormality</td>
<td>41</td>
<td>98%</td>
<td>23 (56%)</td>
<td>36 (88%)</td>
<td>12</td>
<td>3 (25%)</td>
</tr>
<tr>
<td>Hernia</td>
<td>13</td>
<td>93%</td>
<td>12 (92%)</td>
<td>8 (62%)</td>
<td>2</td>
<td>2 (100%)</td>
</tr>
<tr>
<td>IVC mass/thrombus</td>
<td>12</td>
<td>100%</td>
<td>11 (92%)</td>
<td>12 (100%)</td>
<td>7</td>
<td>7 (100%)</td>
</tr>
<tr>
<td>Mediastinal mass</td>
<td>6</td>
<td>83%</td>
<td>6 (100%)</td>
<td>6 (100%)</td>
<td>6</td>
<td>3 (50%)</td>
</tr>
<tr>
<td>Pulmonary embolus</td>
<td>2</td>
<td>100%</td>
<td>2 (100%)</td>
<td>2 (100%)</td>
<td>2</td>
<td>2 (100%)</td>
</tr>
</tbody>
</table>
Conclusions:

- In this large database ECFs were found in 4.4% of studies.
- Majority of ECFs are likely low-risk (pleural effusion, ascites, hernia).
- Reporting ECFs by echo led to changes in management in 32% of patients with available follow up data.
- There is variable practice patterns of experienced readers with regards to identification of ECFs.
- Cardiologists usually report ECFs as general descriptions rather than specific diagnosis.
What Should we do?

- The incidence of important management altering ECFs by TTE and TEE is very low.
- Cardiology and radiology co-reading will not be efficient or cost effective.
- However some ECFs do lead to management changes.
- Focused training of sonographers and physician echoardiographers may be needed on non cardiac pathology especially in liver and mediastinal pathology.
What to do?

• Echocardiography societies should develop training guidelines and make recommendations for reporting of ECFs
• Protocol should be developed for describing important ECFs in TTE and TEE
• Appropriate action for each category of risk should be specified.
• “If you don’t see it doesn’t mean that it is not there”