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ECHO AND CARDiac SOURCE OF EMBOLISM

STROKE

-remains major cause of morbidity and mortality
-kills almost 130,000 Americans each year—that’s 1 in every 19 deaths
-On average, one American dies from stroke every 4 minutes
-Every year, more than 795,000 people in the United States have a stroke. About 610,000 of these are first/new strokes. 1 in 4 are recurrent strokes
-About 87% of all strokes are ischemic
-Stroke costs the U.S an estimated $34.6 billion each year. This total includes the cost of health care services, medications, and missed days of work.

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STROKE

- Etiology
  - Vascular disease- 40%
  - Cardiac Embolic- 30%
  - Lacunar- 10%
  - Cryptogenic- 20%

CARDIAC EMBOLI

- Associated clinical syndromes:
  - Atrial fibrillation
  - LV dysfunction
  - Valvular heart disease
  - Hypercoagulable states

THROMBOEMBOLIC DISEASE:
CARDIAC EVALUATION

- Intercardiac thrombus identification
- Structural abnormalities
- Associated clinical syndromes
**CARDIAC STROKE ECHOCARDIOGRAPHIC FINDINGS**

**Implied**
- Patent Foramen Oval
- Atrial Septal Aneurysm
- Mitral Valve Prolapse
- Mitral Annular Calcification
- Valve Strands

**Culprit Lesion**
- Thrombus
- Complex Plaque (AA)
- Cardiac Tumors (myxoma)
- Vegetations

**Markers**
- LV dysfunction
- LV enlargement
- LA enlargement
- LAA dysfunction
- Spontaneous Contrast
- Complex Plaque (DA)

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**ECHO AND CSE**

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**ATRIAL FIBRILLATION TEE**

**Front End Anticoagulation**
- Thrombus
- Dense "smoke"

**Back End Anticoagulation**
- Stunning
- Mechanical SR
TEE AND ATRIAL THROMBUS

- 231 pts. Undergoing mitral valve surgery
- TEE identified 14 thrombi
- Sensitivity 100%
- Specificity 99%

ECHO AND STROKE

- LV Function
  - EF
  - Thrombus
- Atrial Abn
  - SEC
  - Thrombus
  - LAA Velocity
- Valve disease
- Masses
- Atrial Septum
- PFO
- ASA
- Aortic Atheroma

TEE (60%) TTE (15%)

SPAF III

<table>
<thead>
<tr>
<th>Thromboembolic Events</th>
<th>Group</th>
<th>Combo</th>
<th>ADJ INR</th>
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<tbody>
<tr>
<td>SEC</td>
<td>Faint</td>
<td>6%</td>
<td>2.8%</td>
</tr>
<tr>
<td></td>
<td>Dense</td>
<td>18%</td>
<td>4.5%</td>
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<tr>
<td>Thrombus</td>
<td>Absent</td>
<td>7.2</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>Present</td>
<td>12.9</td>
<td>17.9</td>
</tr>
<tr>
<td>LAA vel</td>
<td>&lt;20</td>
<td>13.1</td>
<td>6.7</td>
</tr>
<tr>
<td></td>
<td>&gt;20</td>
<td>8.3</td>
<td>1.4</td>
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</table>
CHADS² RISK STRATIFICATION SCHEME

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Score</th>
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<tbody>
<tr>
<td>C Recent congestive heart failure</td>
<td>1</td>
</tr>
<tr>
<td>H Hypertension</td>
<td>1</td>
</tr>
<tr>
<td>A Age &gt;75 yrs</td>
<td>1</td>
</tr>
<tr>
<td>D Diabetes mellitus</td>
<td>1</td>
</tr>
<tr>
<td>S₂ Hx of stroke or transient ischemic attack</td>
<td>2</td>
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</tbody>
</table>

Relationship Between CHADS² Score and Risk of Stroke

Stroke Rate (%)  
CHADS² Score

TEE AND STROKE

<table>
<thead>
<tr>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrial Fibrillation</td>
</tr>
<tr>
<td>Risk Stratify</td>
</tr>
<tr>
<td>Cardioversion</td>
</tr>
<tr>
<td>Suspected Cardiac Emboli</td>
</tr>
</tbody>
</table>
A-FIB RISK STRATIFICATION

TEE:
- LA Thrombus
- LA spontaneous contrast
- LAA velocity
- Aortic complex plaque

TEE AND STROKE (SPAF III RESULTS)

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>Stroke Rate, %/y (Cases/Total)</th>
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</thead>
<tbody>
<tr>
<td>Left Atrial Abnormality</td>
<td>7.8% (4/50)</td>
</tr>
<tr>
<td>Complex Aortic Plaque</td>
<td>12.0% (4/31)</td>
</tr>
<tr>
<td>Both</td>
<td>20.0% (7/35)</td>
</tr>
<tr>
<td>Neither</td>
<td>1.3% (1/61)</td>
</tr>
</tbody>
</table>
# Atrial Stasis

- SEC/Smoke
- Atrial appendage velocity
- Thrombus

## Atrial Thrombi Among Patients with Newly Recognized AF

<table>
<thead>
<tr>
<th>Study</th>
<th>No. of Patients</th>
<th>No. (%) With Atrial Thrombi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stoddard (1995)</td>
<td>206</td>
<td>37 (18%)</td>
</tr>
<tr>
<td>ACUTE Pilot (1997)</td>
<td>56</td>
<td>7 (13%)</td>
</tr>
<tr>
<td>Weigner (2001)</td>
<td>539</td>
<td>70 (13%)</td>
</tr>
<tr>
<td>ACUTE, Klein (2001)</td>
<td>619</td>
<td>76 (12%)</td>
</tr>
<tr>
<td>Corrado (1999)</td>
<td>123</td>
<td>11 (9%)</td>
</tr>
</tbody>
</table>

References:
- Corrado et al. Chest. 1999;115:140-143
- Stoddard et al. Am Heart J. 1995;129:1204-1215
TUMORS
- Myxomas
- Fibroelastoma
- Metastatic

MYXOMA

TUMOR VS THROMBUS
More prevalent in patients with cryptogenic stroke

Risk Factors:
- Size
- Shunting
- Pressures
- Associated ASA
- Closure

Risk Factors:
- Early shunting
- Marked shunting
- Associated ASA
- Hypercoagulable risk
- Previous stroke
PFO AND STROKE

- Most common consistent component of fetal circulation
- Variable size (1-19 mm)
- High prevalence in stroke
- Shunting with normal PA pressures
LV THROMBUS
- Post MI
- CMP
- WARCEF
- Role of TTE

VALVE DISEASE
- Mitral Stenosis
- Valve strands
- Lambl's
- Endocarditis
- Prosthetic Valves

FEVER/STROKE
ATRIAL SEPTUM

- PFO / ASD
- ASA
- Lipomatous

AORTIC ATHEROMA

- Complex plaque
- Location
- Treatment
- Marker in AFib
- High prevalence in stroke
- Associated with carotid disease (marker)
- Protruding (>4mm) and mobile components highest risk
- Best identified with TEE
- Optimal RX unknown
STROKE AND AORTIC PLAQUE

French Stroke Group NEJM 1996

PLAQUE MORPHOLOGY VS ANTICOAGULATION

Follow-up Events (Dressler JACC 1994)

AORTIC ATEROMAS

- High prevalence in stroke
- Associated with carotid disease (marker)
- Protruding (>4mm) and mobile components highest risk
- Best identified with TEE
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