CASE

- 79 year old Patient X was admitted to hospital with SOB. He had a hx of sarcoidosis and asbestosis. Home oxygen requirement is 3-3.5 litre. He was admitted, given ceftriaxone azithromycin and duonebs.

- At nurse called resident as pt was not responding. At that time vitals were stable Bp 110/75 HR<20. Pt was appropriately responding to the resident. Was advised to decrease oxygen to keep sat >92%

- Next morning, pt was noted to have AMS and aphasia which was new. As per nursing this happened 7 hours ago. At this time neurology was called. Pt was already outside the window for TPA
Physical exam showed: Awake, alert with expressive speech difficulty. He was able to simple instructions. At times, he was not able to understand questions and commands. Had some visual neglect on both sides. Also was not able to do finger-to-nose and heel-to-shin test. Sensory exam was not done. Rest of exam was WNL

- CAT scan showed areas of decreased attenuation over left frontal and right parietal regions.
- MRI was done that showed bilateral cortical subcortical and periventricular infarcts in multiple vascular territories; possible embolic
Stroke workup was done
Echocardiogram showed EF of 60%. LA mass on septal side/mitral annulus of MV moderate to large, probable myxoma, clot could not be ruled out. Recommended TEE. Rest echo was normal
Cardiology was consulted. TEE was done, showed evidence of PFO with right to left shunt
LLE venous doppler was done that showed echogenic rt superficial femoral vein possible old clot
DIAGNOSIS

- Acute CVA
ACUTE CVA

- Two Types:
  - Cryptogenic Stroke
  - Organic Strokes
Cryptogenic strokes are strokes without an identifiable cause. More common in people <55 years of age.

Cryptogenic strokes are caused by small emboli that travel from the legs to the right atrium; during straining (such as a Valsalva maneuver) these emboli can go across a PFO into the left atrium and then travel to the brain, producing a stroke. These are also called paradoxical emboli.
PARADOXICAL EMBOLISM (PDE)

- The disease starts with the formation of emboli within the venous system, which traverse a patent foramen ovale (PFO) and enter the systemic circulation.

- PDE originates in the veins of the lower extremities and occasionally in the pelvic veins. Emboli may be of various types, such as clots, air, tumor, fat, and amniotic fluid.
EPIDEMIOLOGY

- Of the 700,000 strokes per year in the United States, 80% of them are ischemic, and 20% of those are defined as cryptogenic.
- Prevalence of PFO among this cryptogenic stroke population is about 40% to 50%; in the general population, it's only about 20%.
- Current estimates are that somewhere between 30,000 and 60,000 strokes per year in the U.S. are caused by paradoxical embolism through a PFO.
- Above age 65 into the 80s, patients were 3 times more likely to have a stroke or death if a PFO was present, even accounting for other risk factors usually associated with atherosclerosis.
Elderly patients are commonly affected
The risk of DVT is increased in the elderly population; this is correlated with the increased incidence of PDE in patients older than 55 years.
Elderly patients may be at increased risk for the passage of thrombus through a PFO. The size of the PFO is usually greater in this age group than in younger populations; the average size of a PFO is 3 mm in the first decade of life versus 6 mm in the 10th decade of life.
The sexes are equally represented in the demographics of the disease because there is no sex-related difference in the incidence of PFO in the normal population.
No established differences exist across racial or ethnic groups.
CAUSES OF STROKE

- Atherosclerosis
- Thrombotic diathesis
- Autoimmune disease
- Vasculitis
- Severe migrainous attack
- Cardioembolic conditions
The clinical findings of PDE are arterial embolic manifestations that include cerebral (40%), peripheral (50%), coronary (8%), renal (1%), and splenic (1%) ischemia or infarction. PE has been demonstrated in as many as 85% of diagnosed cases of PDE. Chronically elevated pressures of the right side of the heart are associated with 5% of PDE cases.

Jonathen et al. Texas Heart Inst J V32.(3);2005
DIAGNOSIS

- Transthoracic echocardiography
- Trans-esophageal echocardiography
- Transcranial Doppler
Trans esophageal echocardiogram is gold standard but has its limitations
  - Patient sedation, position in the left decubitus position and the inability to perform a complete valsalva makes it more difficult to visualize a shunt

Trans thoracic echocardiogram
  - Ability to perform valsalva but poor image quality
DIAGNOSIS (CONT'D)

- Transcranial Doppler
  - Best screening technique
  - Cannot distinguish between PFO, ASD and less commonly pulmonary AV malformations
TREATMENT

- Antiplatelet Agents (aspirin, plavix or dipyridamole)
- Warfarin
- Surgical Closure
- Percutaneous Device Closure
Meta-analysis of 5 retrospective studies showed surgical closure was superior to medical treatment (warfarin or antiplatelet therapy) in preventing recurrent neurologic events (OR 0.27, 95% CI)

Above finding was mainly due to superiority over antiplatelet therapy
TREATMENT (CONT'D)

- Direct surgical of PFO is the definitive treatment but stroke recurrence rates have been between 0% to 19.5%

- Now new percutaneous device techniques are available
  - Recurrent neurologic effects range from 0 to 3.8% per year
Amplatzer now used. Importantly,

- 100 patients with PFO closure, no recurrence of stroke or transient ischemic attack over the 4 years that we've been following these cases.
- Currently, there are 2 ongoing randomized trials that will attempt to test whether device closure of patent foramen ovale is preferable to continuous medical therapy to prevent recurrent stroke from paradoxical embolism.

Jonathen et al. Texas Heart Inst J 32(3);2005
Medical treatment of stroke in patients with PFO (using warfarin or antiplatelet agents) does not lead to an increased risk of recurrent stroke or death compared to secondary prevention in patients with cryptogenic stroke without a PFO (SOR A; Ref. 1)

A joint guideline of the American Heart Association and American Stroke Association recommends antiplatelet therapy for patients with stroke and PFO and states that evidence is insufficient to establish whether oral anticoagulation offers additional benefit (SOR B; Ref. 1)
Cardiac surgery was consulted. Pt was put on lovenox therapy and then bridged to coumadin for 2-3 months prior to closure of PFO. He was not a candidate for long term anticoagulation. Unfortunately our patient was readmitted in 3 weeks and he passed away secondary to respiratory failure.
**RECOMMENDATIONS**

**Table 3. Clinical and Morphologic Features Associated With Recurrent Paradoxical Embolic Events**

<table>
<thead>
<tr>
<th>History</th>
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<tbody>
<tr>
<td>Valsalva maneuver preceding the</td>
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<tr>
<td>cerebrovascular ischemic event⁶</td>
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<tr>
<td>Coexisting cause of stroke (in particular,</td>
</tr>
<tr>
<td>hypercoagulable state)¹¹</td>
</tr>
<tr>
<td>Multiple strokes or events</td>
</tr>
<tr>
<td>(in particular, those involving different</td>
</tr>
<tr>
<td>signs and symptoms)⁶</td>
</tr>
<tr>
<td>Patent foramen ovale characteristics</td>
</tr>
<tr>
<td>Large opening</td>
</tr>
<tr>
<td>Large right-to-left shunting (defined on the</td>
</tr>
<tr>
<td>basis of number of contrast microbubbles seen</td>
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<tr>
<td>on echocardiographic study of the left atrium</td>
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<tr>
<td>after full opacification of the right atrium)⁴⁴,⁴⁵,⁴⁷</td>
</tr>
<tr>
<td>Right-to-left shunting at rest⁹³</td>
</tr>
<tr>
<td>Presence of an atrial septal aneurysm⁹²,⁹³-⁹⁴</td>
</tr>
</tbody>
</table>

**Figure 4. Algorithm for managing patent foramen ovale (PFO) in patients with cryptogenic stroke.**

TIA indicates transient ischemic attack.
The true risk of primary or recurrent ischemic stroke associated with PFO and atrial septal aneurysm is difficult to estimate. However, available data can be summarized as follows:

- Multiple case-control trials have reported an increased prevalence of PFO in patients who have had a cryptogenic stroke, suggesting that PFO is frequent cause of cryptogenic stroke.
- Population-based cohort studies, which enrolled predominantly older subjects, have found no statistically significant association between the risk of first ischemic stroke and presence of a PFO.

CONCLUSIONS
REFERENCES

