Beth Israel Deaconess Medical Center

Greg Haman, HMS III
Gillian Lieberman, MD

November, 2013

A Hazardous Change of Heart: Infective Endocarditis and its Complications

Greg Haman, Harvard Medical School Year III

Gillian Lieberman, MD

Beth Israel Deaconess Medical Center
Greg Haman, HMS III
Gillian Lieberman, MD

Learning Objectives

- Know risk factors for, physical exam stigmata of, and diagnostic criteria of infective endocarditis (IE)
- Understand role of imaging in work up of IE
- Recognize common complications of IE on imaging
- Describe complications with terms appropriate to each modality

Greg Haman, HMS III
Gillian Lieberman, MD

Our Patient: Presentation

JS is a 32 y/o female with history of IVDU who presents to OSH with altered mental status. She c/o chest pain, worse with inspiration.

Beth Israel Deaconess Medical Center
Greg Haman, HMS III
Gillian Lieberman, MD

Our Patient: Past Medical History

- Hand abscess from skin popping
  - Injection of drugs subcutaneously or intramuscularly
  - Lack of viable veins

http://see.visualdx.com/diagnosis/substance_abuse_skin_popping

Greg Haman, HMS III
Gillian Lieberman, MD

Our Patient: Workup at OSH

Toxicology screen + for cocaine and heroin.

Blood cultures grew MRSA. Started on vancomycin.

Transferred to BIDMC out of concern for infective endocarditis.

IE: Epidemiology and Pathology

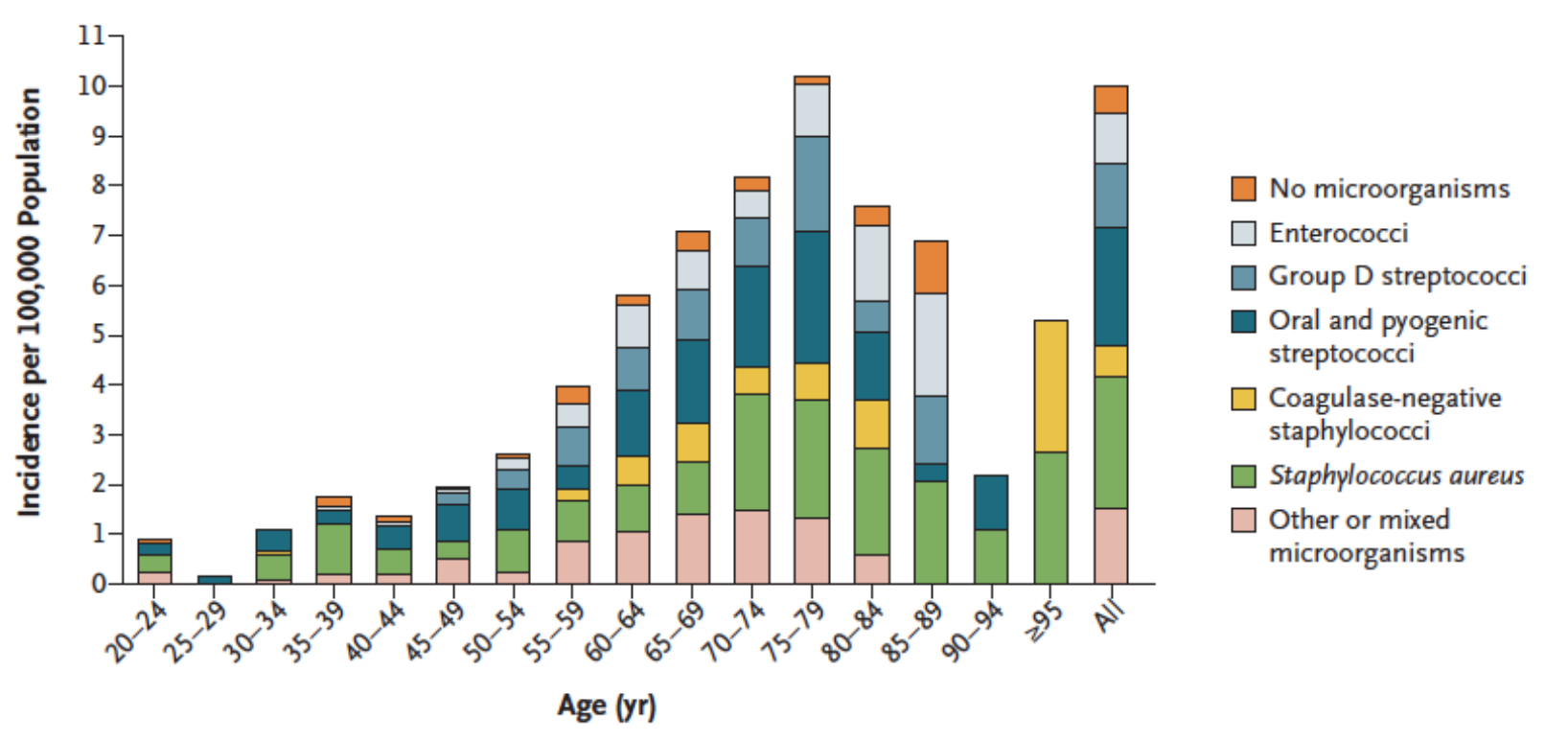
- Infection of endocardium of heart, especially heart valves
- Incidence of ~1.5 to 3.3 cases per 1000 IVDU per year
- Vegetations can form in heart
  - Consist of fibrin, platelets, infectious organisms
  - Embolization of vegetations results in complications including abscesses and infarcts at myriad locations

Hoen, Bruno and Xavier Duval. Infective Endocarditis. *New England Journal of Medicine.* 2013; 368, 15: 1425-1433.

Beth Israel Deaconess Medical Center
Greg Haman, HMS III
Gillian Lieberman, MD

IE: Infectious Organisms

- 80% of all infections are staph and strep
- Most commonly S. aureus in IV drug users
- Different organisms are more common in particular subsets of patients



Hoen, Bruno and Xavier Duval. Infective Endocarditis. *New England Journal of Medicine*. 2013; 368, 15: 1425-1433.

Greg Haman, HMS III
Gillian Lieberman, MD

IE: Classification

- Acute vs. sub acute
  - Acute: severe symptoms, develops over days, commonly Staph aureus
  - Sub acute: mild symptoms, develops over weeks to months, commonly Strep Viridans or enterococci
- Native vs. prosthetic valve
- Right sided vs. left sided

IE: Risk Factors

- Male:Female >2:1
- Dental procedures or disease
- IVDU
- indwelling IV catheters
- implantable cardiac devices
- Cardiac surgery
- Extra-cardiac sites of infection
- History of IE

Learning Objectives

- Know risk factors for, physical exam stigmata of, and diagnostic criteria of infective endocarditis (IE)
- Understand role of imaging in work up of IE
- Recognize common complications of IE on imaging
- Describe complications with terms appropriate to each modality

You are sent to evaluate the patient. What signs do you look for?

IE: Physical Examination

- Fever
  - Common, occurring in 80% of cases
- New Murmur or worsening of old murmur
  - 20-48% of IE pts.
- Splenomegaly
  - 11% of IE pts.
- Splinter Hemorrhages
  - 8% of IE pts.
- Janeway lesions
  - 5% of IE pts.
- Roth's Spots
  - 5% of IE pts.

Hoen, Bruno and Xavier Duval. Infective Endocarditis. *New England Journal of Medicine.* 2013; 368, 15: 1425-1433.

Beth Israel Deaconess Medical Center
Greg Haman, HMS III
Gillian Lieberman, MD

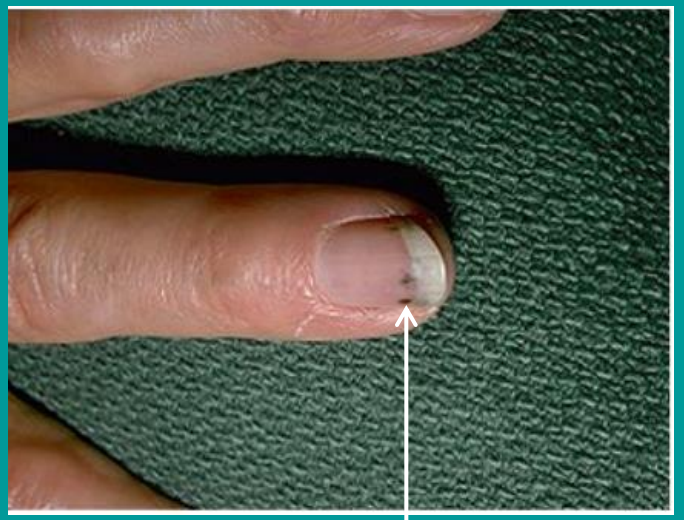
IE: Physical Examination

Pause to identify these physical exam findings and then continue to reveal their names

Rao, T. V. Infective Endocarditis: An Update. http://www.authorstream.com/Presentation/doctorrao-1857155-infective-endocarditis/ . Accessed November 17, 2013

Beth Israel Deaconess Medical Center
Greg Haman, HMS III
Gillian Lieberman, MD

IE: Physical Examination



Splinter Hemorrhages

Roth's Spots

Janeway Lesions

Rao, T. V. Infective Endocarditis: An Update. http://www.authorstream.com/Presentation/doctorrao-1857155-infective-endocarditis/ . Accessed November 17, 2013

Greg Haman, HMS III
Gillian Lieberman, MD

Our Patient: Physical Examination

- Vitals: stable, **afebrile**
- General: fatigued, NAD
- Skin: **No peripheral cutaneous/mucocutaneous lesions, petechiae, splinter hemorrhages, Janeway lesions, Osler's nodes noted**
- HEENT: Conjunctiva clear, **no Roth Spots noted**
- Heart: **soft systolic murmur over left sternal border 3/6**
- Lungs: **bilateral rales and rhonchi**
- Abdomen: soft, NT/ND, **no hepatomegaly or splenomegaly**

Learning Objectives

- Know risk factors for, physical exam stigmata of, and diagnostic criteria of infective endocarditis (IE)
- Understand role of imaging in work up of IE
- Recognize common complications of IE on imaging
- Describe complications with terms appropriate to each modality

Greg Haman, HMS III
Gillian Lieberman, MD

IE: Diagnosis

- Duke's Criteria
  - Two major, one major and three minor, or five minor criteria
    - Major criteria
      - + Blood Culture
      - Evidence of endocardial involvement
        - Echocardiogram findings
    - Minor Criteria
      - Predisposition to IE
      - Fever (>38C)
      - Vascular Phenomena
      - Immunologic Phenomena
      - Microbiological Involvement

Learning Objectives

- Know risk factors for, physical exam stigmata of, and diagnostic criteria of infective endocarditis (IE)
- Understand role of imaging in work up of IE
- Recognize common complications of IE on imaging
- Describe complications with terms appropriate to each modality

Greg Haman, HMS III
Gillian Lieberman, MD

What imaging do you want?

IE: ACR Criteria

- Rating system
  - 7-9: usually appropriate
  - 4-6: may be appropriate
- CXR (Rating: 8)
  - Evaluates for
    - cardiac chamber size
    - pulmonary venous HTN and edema
      - presence and severity of heart failure
    - pulmonary infarcts and abscesses from emboli

IE: ACR Criteria

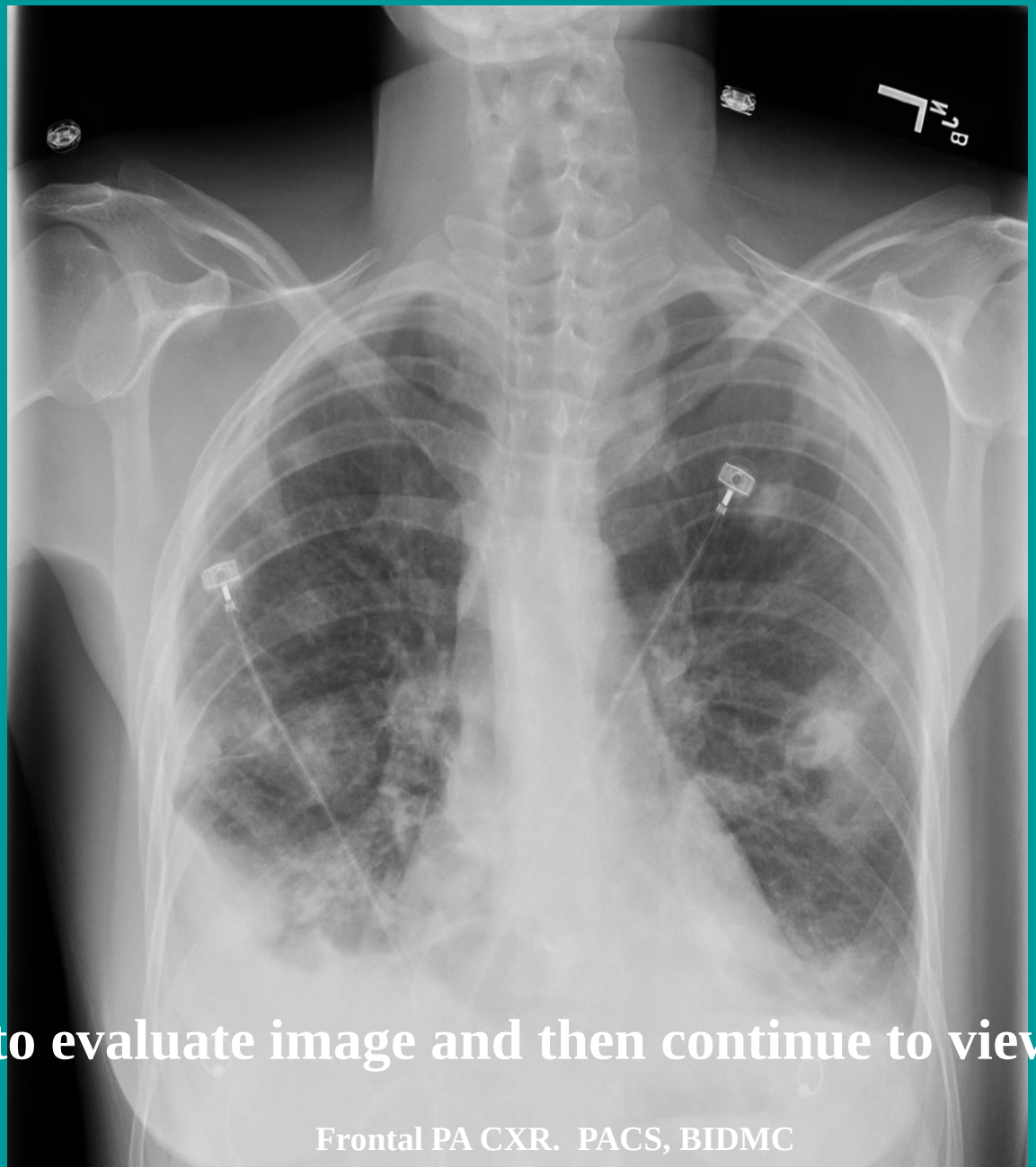
- Ultrasonography
  - PPV 97%
  - NPV 94%
  - Evaluates for
    - Vegetations
    - Severity of Valvular damage and valvular regurgitation
    - Perivalvular abscess
- TTE (Rank:9) vs. TEE (Rank:8)
  - TEE more sensitive for vegetations
  - TTE more cost effective if high pre-test probability

Learning Objectives

- Know risk factors for, physical exam stigmata of, and diagnostic criteria of infective endocarditis (IE)
- Understand role of imaging in work up of IE
- Recognize common complications of IE on imaging
- Describe complications with terms appropriate to each modality

Beth Israel Deaconess Medical Center
Greg Haman, HMS III
Gillian Lieberman, MD

Our Patient: CXR

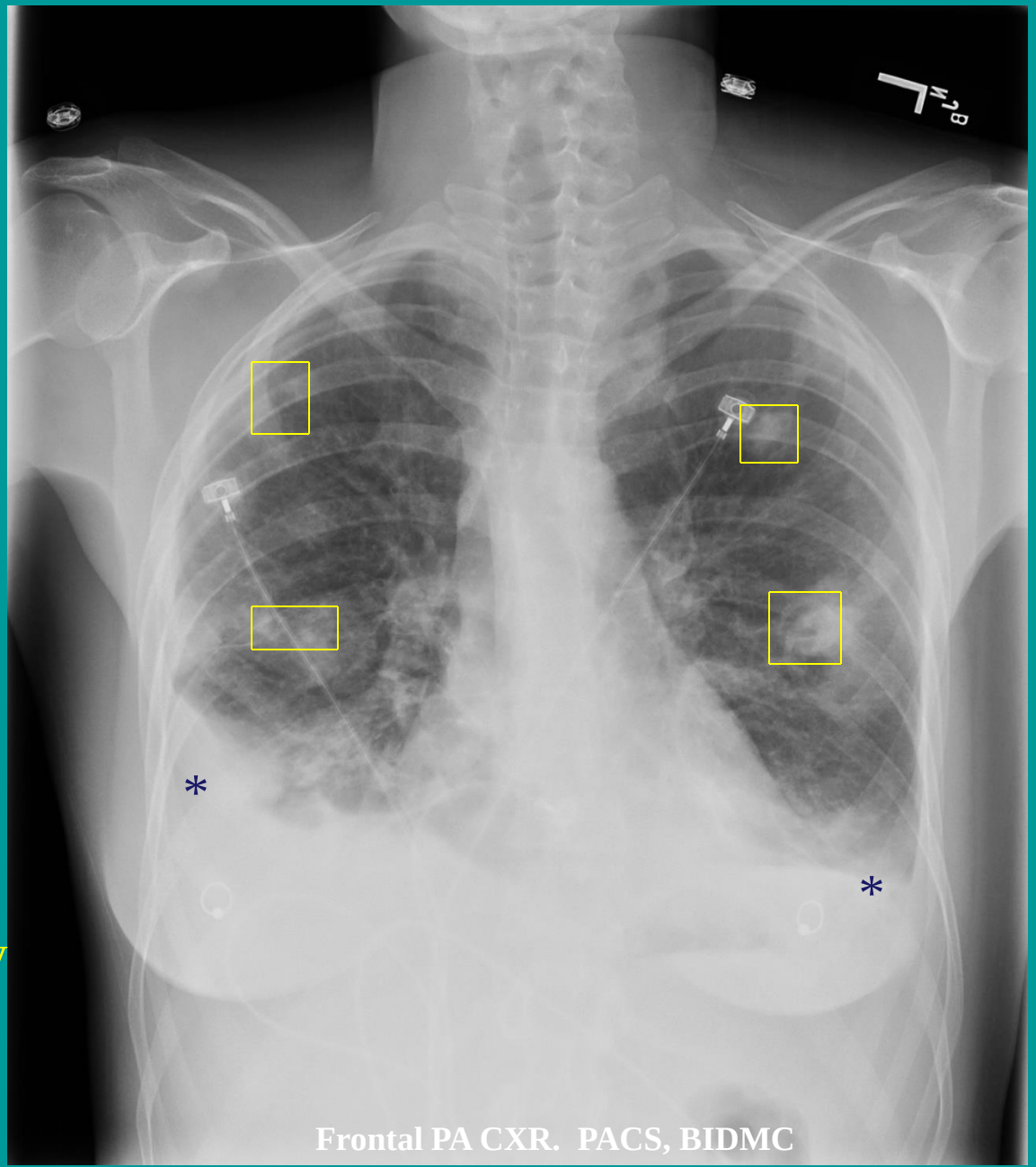


Pause to evaluate image and then continue to view findings

Frontal PA CXR. PACS, BIDMC

Beth Israel Deaconess Medical Center
Greg Haman, HMS III
Gillian Lieberman, MD

Our Patient: CXR

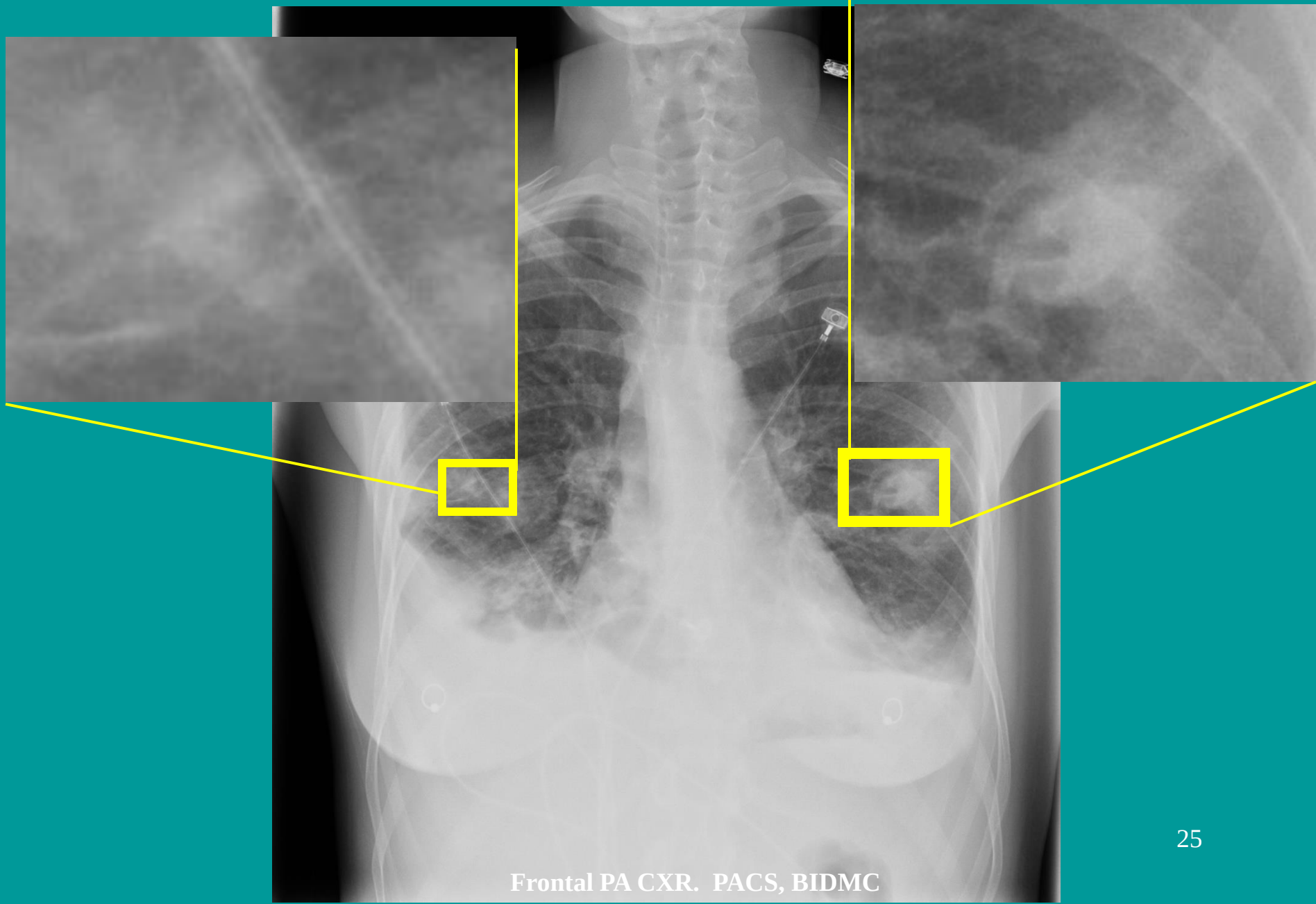


Findings:
1. Rounded Opacities with Internal Lucency
2. Pleural Effusions

Frontal PA CXR. PACS, BIDMC

Beth Israel Deaconess Medical Center
Greg Haman, HMS III
Gillian Lieberman, MD

Our Patient: CXR

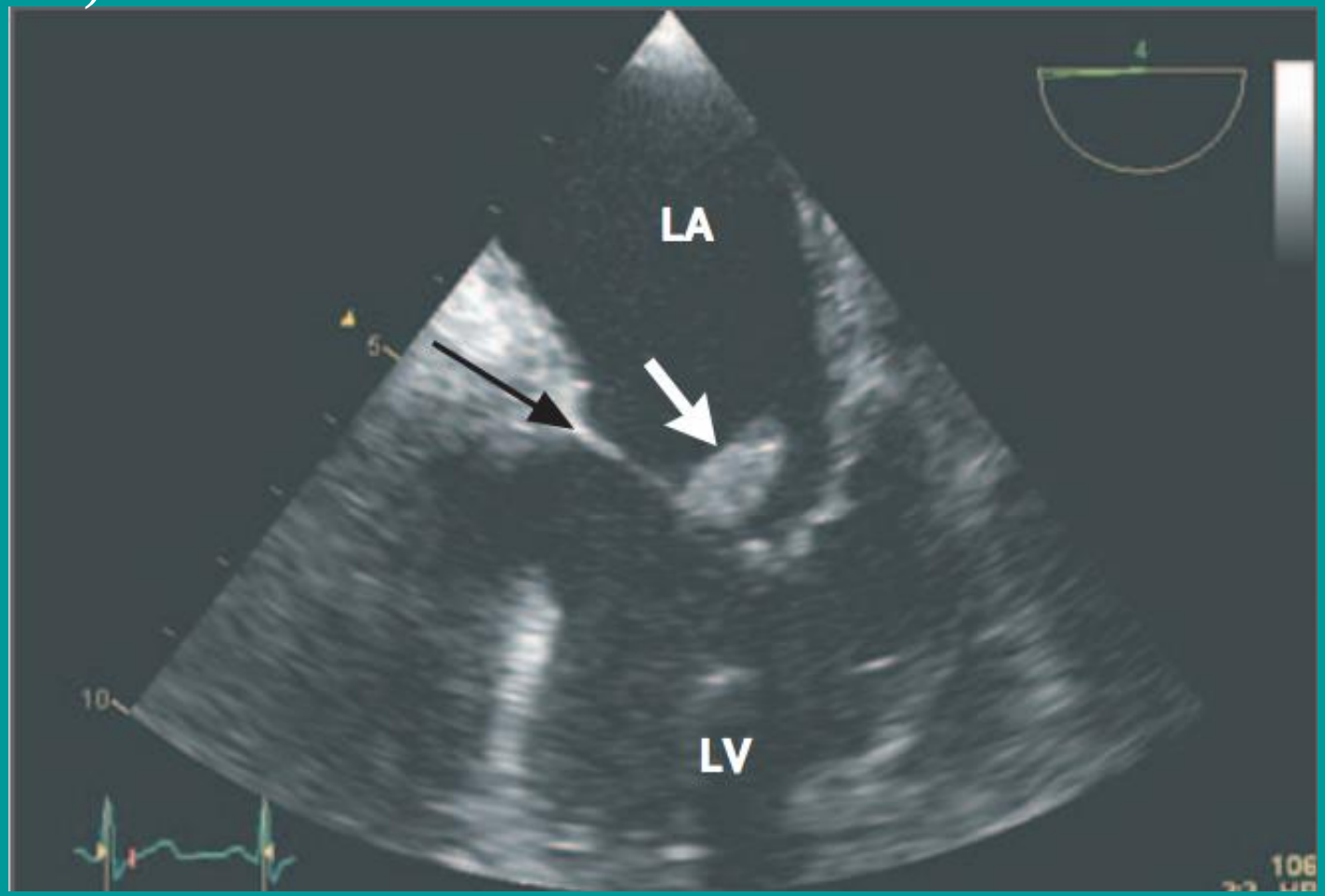


Frontal PA CXR. PACS, BIDMC

Beth Israel Deaconess Medical Center
Greg Haman, HMS III
Gillian Lieberman, MD

Companion Patient 1: TTE

- Large vegetation (white arrow) seen near mitral valve (black arrow)



Hoen, Bruno and Xavier Duval. Infective Endocarditis. *New England Journal of Medicine.* 2013; 368, 15: 1425-1433.

Greg Haman, HMS III
Gillian Lieberman, MD

Our Patient: TTE

- 1cm echogenic mobile mass in right ventricle attached to cordae
  - fibroelastoma, myxoma, vegetation
- No valvular abnormalities or regurgitation
- Left ventricle and atrium normal

Greg Haman, HMS III
Gillian Lieberman, MD

Does our patient have IE?

Our Patient: Diagnosis

- By Duke's Criteria, our patient has IE 2 major criteria
  - + Blood Cultures: MRSA
  - Evidence of cardiac involvement (on TTE, exam)
- Additionally our patient satisfied at least one minor criteria
  - Predisposition to IE
    - History of IVDU
    - Tested positive for cocaine and heroin on admission at OSH
- Thus our patient has IE

IE: Treatment

- Antibiotics
  - Identification of causal organism and its susceptibility is crucial
  - Treatment lasts 2-6 weeks
    - Depends on organism, antibiotics, native vs. prosthetic valve, etc.
  - For MRSA consider vancomycin with daptomycin as an alternative
- Surgery
  - may be indicated to remove infected material or drain abscesses

Gordon, Rachel and Franklin Lowy. Bacterial Infections in Drug Users. *NEJM.* 2005; 353, 18: 1945-1954.

Greg Haman, HMS III
Gillian Lieberman, MD

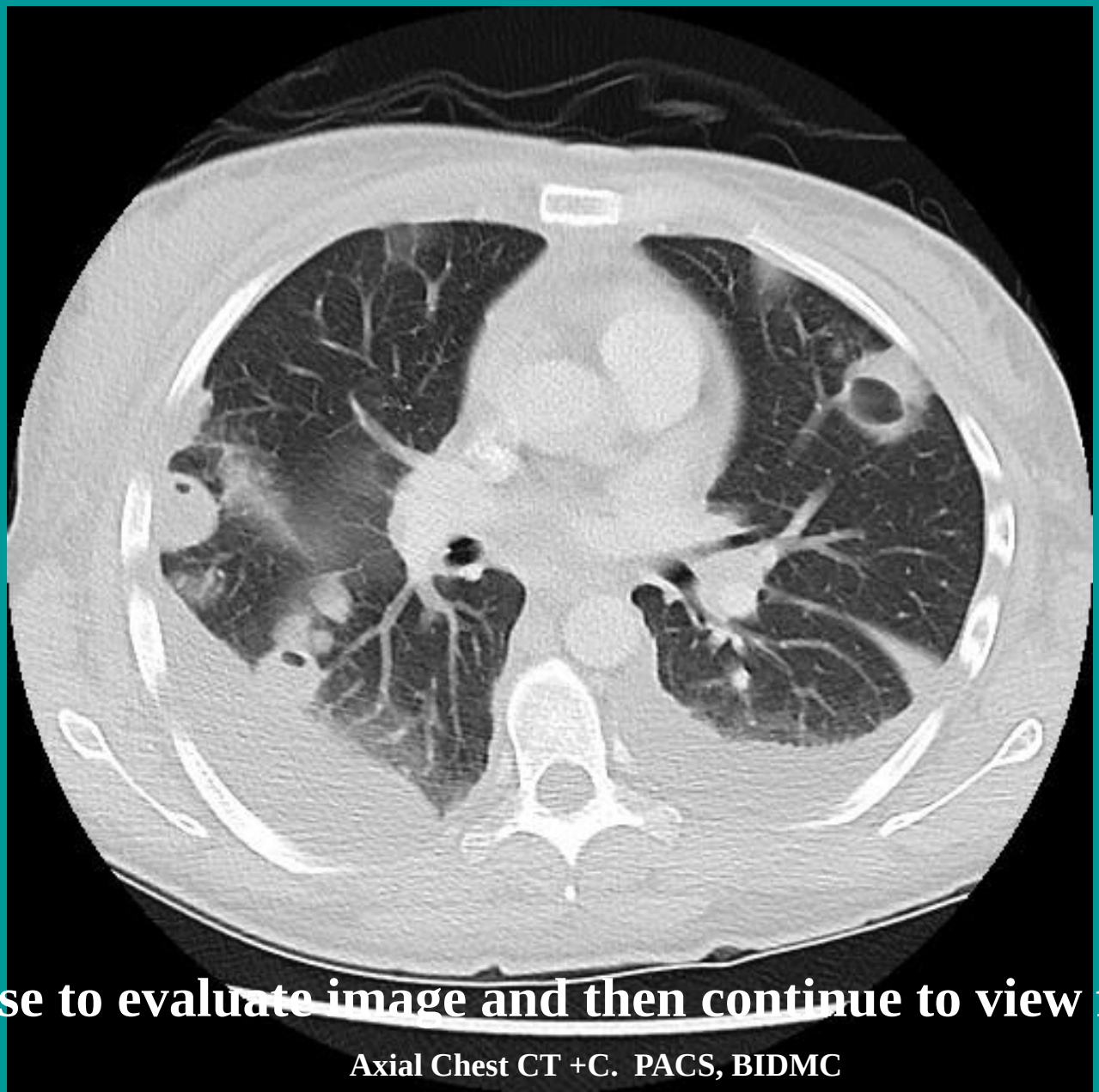
IE: Complications

- Pathogenesis
  - Local spread
    - Heart valve destruction
  - Metastatic spread
    - Lung abscess
    - Vertebral osteomyelitis
  - Embolic
    - Lung Embolus
    - Cerebral infarct
  - Immune mediated damage
    - Glomerulonephritis

In light of our pt.'s presentation with chest pain, worse with inspiration, and the lesions visualized on CXR, a Chest CT +C was ordered

Beth Israel Deaconess Medical Center
Greg Haman, HMS III
Gillian Lieberman, MD

Our Patient: Chest CT



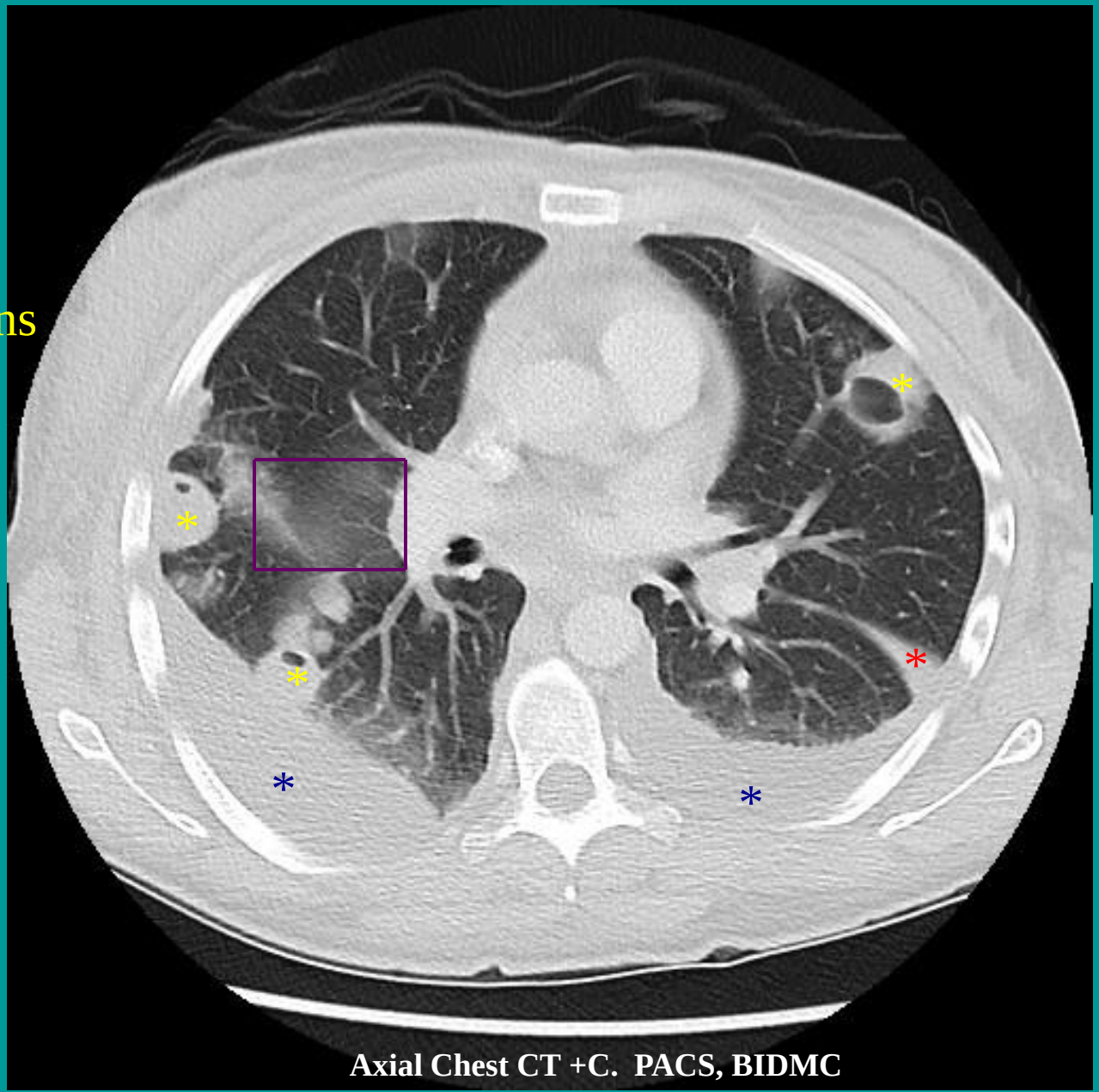
Pause to evaluate image and then continue to view findings

Axial Chest CT +C. PACS, BIDMC

Beth Israel Deaconess Medical Center
Greg Haman, HMS III
Gillian Lieberman, MD

Our Patient: Chest CT

Findings:
1. Rounded Consolidations With Cavitations
2. Ground Glass Opacities
3. Pleural Effusions
4. Fluid in L Major Fissure



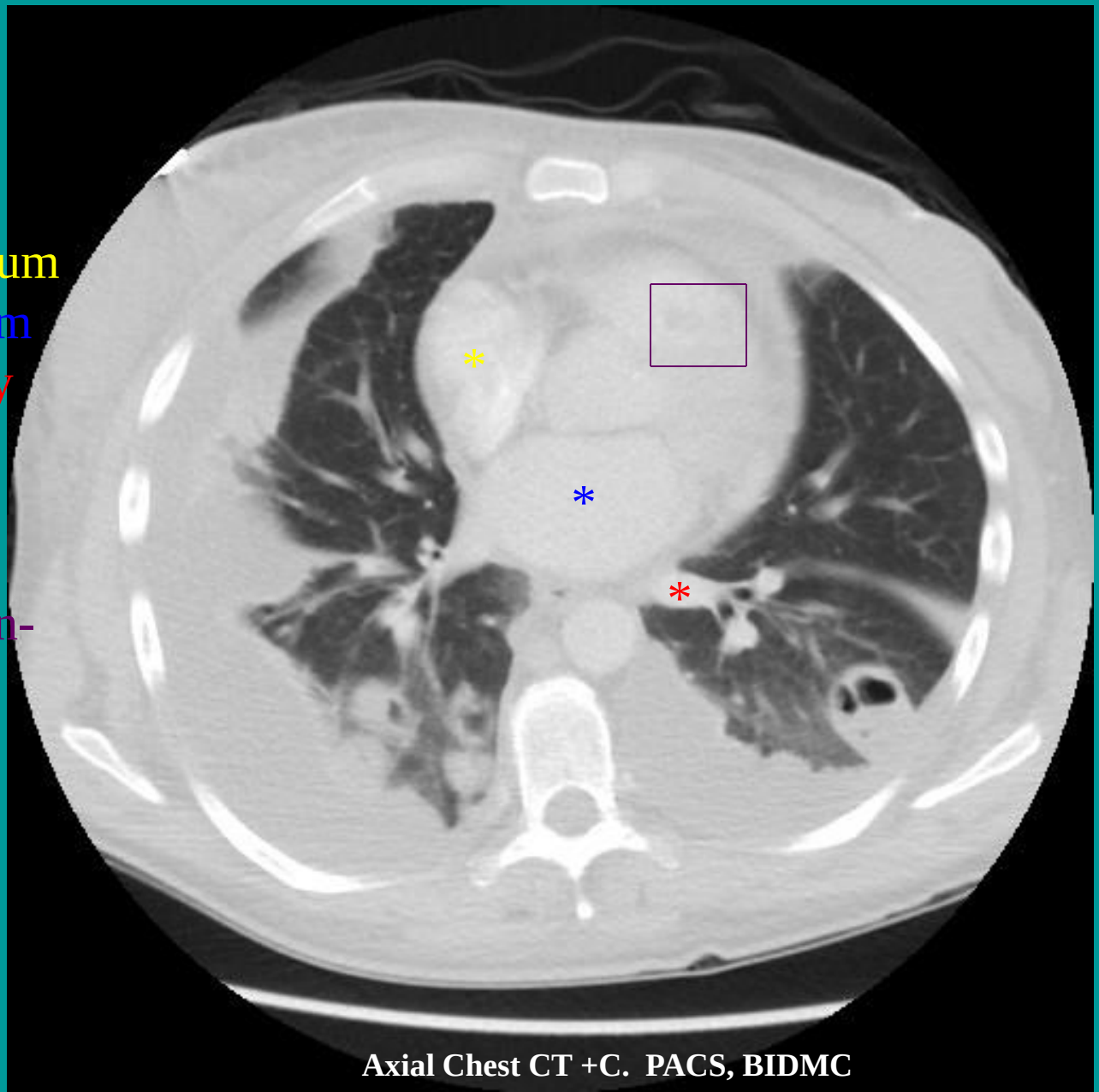
Axial Chest CT +C. PACS, BIDMC

Beth Israel Deaconess Medical Center
Greg Haman, HMS III
Gillian Lieberman, MD

Our Patient: Chest CT

Structures:
1. Right Atrium
2. Left Atrium
3. Pulmonary Vein

Findings:
1. 1.8 cm non-enhancing hypodensity in R vent lumen



Axial Chest CT +C. PACS, BIDMC

After one week of IV vanc, JS continues to have fevers. What are you concerned about?

Concern for an abscess or infarct caused by septic thromboemboli should be high. Imaging can help locate these.

What locations and modalities would you consider using?

Greg Haman, HMS III
Gillian Lieberman, MD

Our Patient: CT abdomen

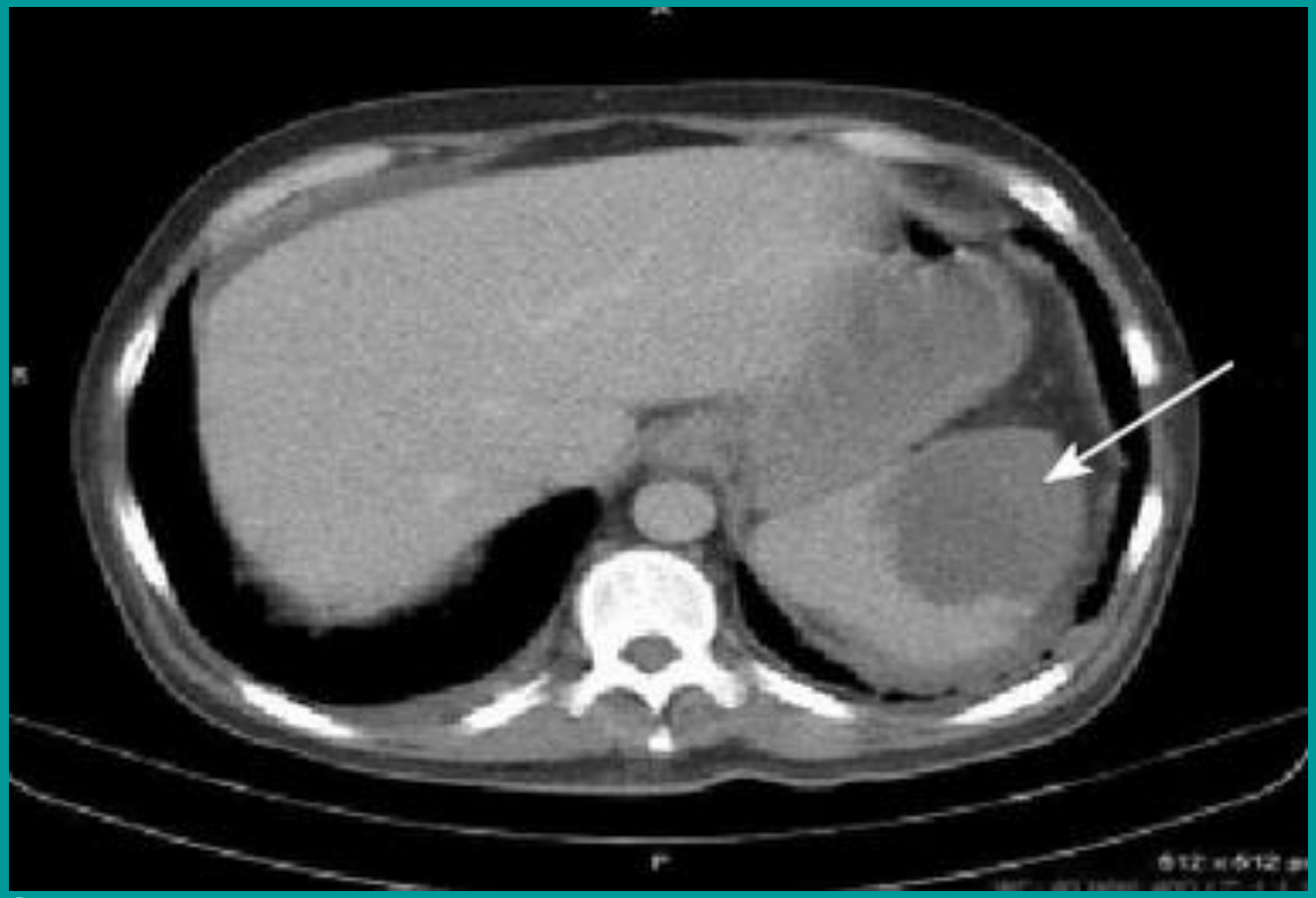
- Look for intra-abdominal abscess, infarct
- Negative CT abdomen and pelvis +C

Atilla, Ozge, Zeynep Temizyurek, and Egemen Kirman. Infective Endocarditis complicated with cerebral and splenic infarction in a hemodialysis patient. World Journal of Emergency Medicine. Accepted after revision July 20, 2013.

Beth Israel Deaconess Medical Center
Greg Haman, HMS III
Gillian Lieberman, MD

Companion Patient 3: CT abdomen

- hypodense splenic lesion (white arrow) suggestive of splenic infarct



Axial CT Abdomen +C.

Atilla, Ozge, et al. Infective Endocarditis complicated with cerebral and splenic infarction… World Journal of Emergency Medicine.

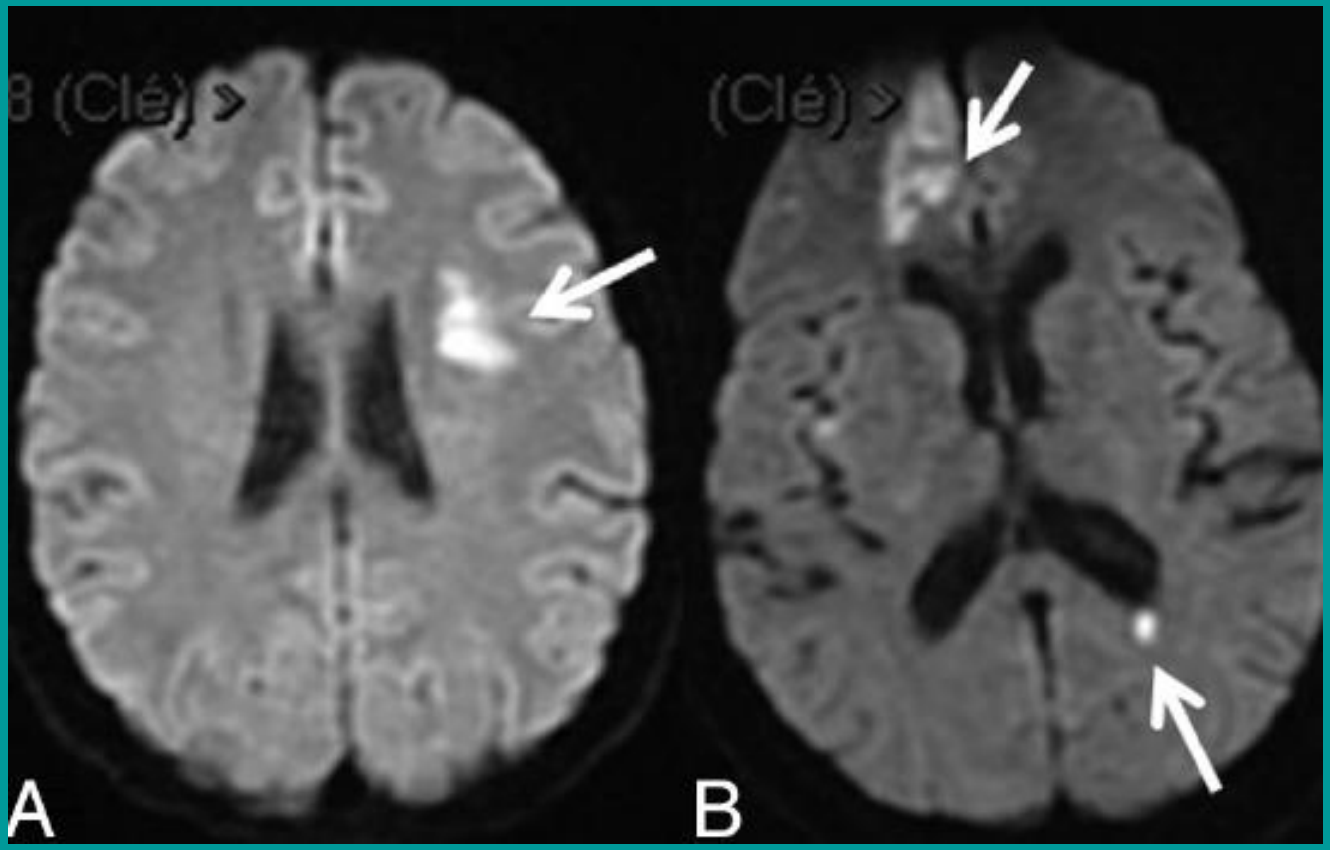
Our Patient: Head CT

- Look for microabscesses, septic emboli and infarction
- Negative CT Head -C

Beth Israel Deaconess Medical Center
Greg Haman, HMS III
Gillian Lieberman, MD

Companion Patient 2: MRI Head

- Ischemic lesions (white arrows) on DWI MRI
  - A: single territorial infarct.
  - B: territorial and small cortical and/or subcortical infarcts.



Axial DWI MRI.

Hess, A. et al. Brain MRI Findings…American Journal of Neuroradiology. 34: 1579-84. August, 2013.

Our Patient: MRI spine

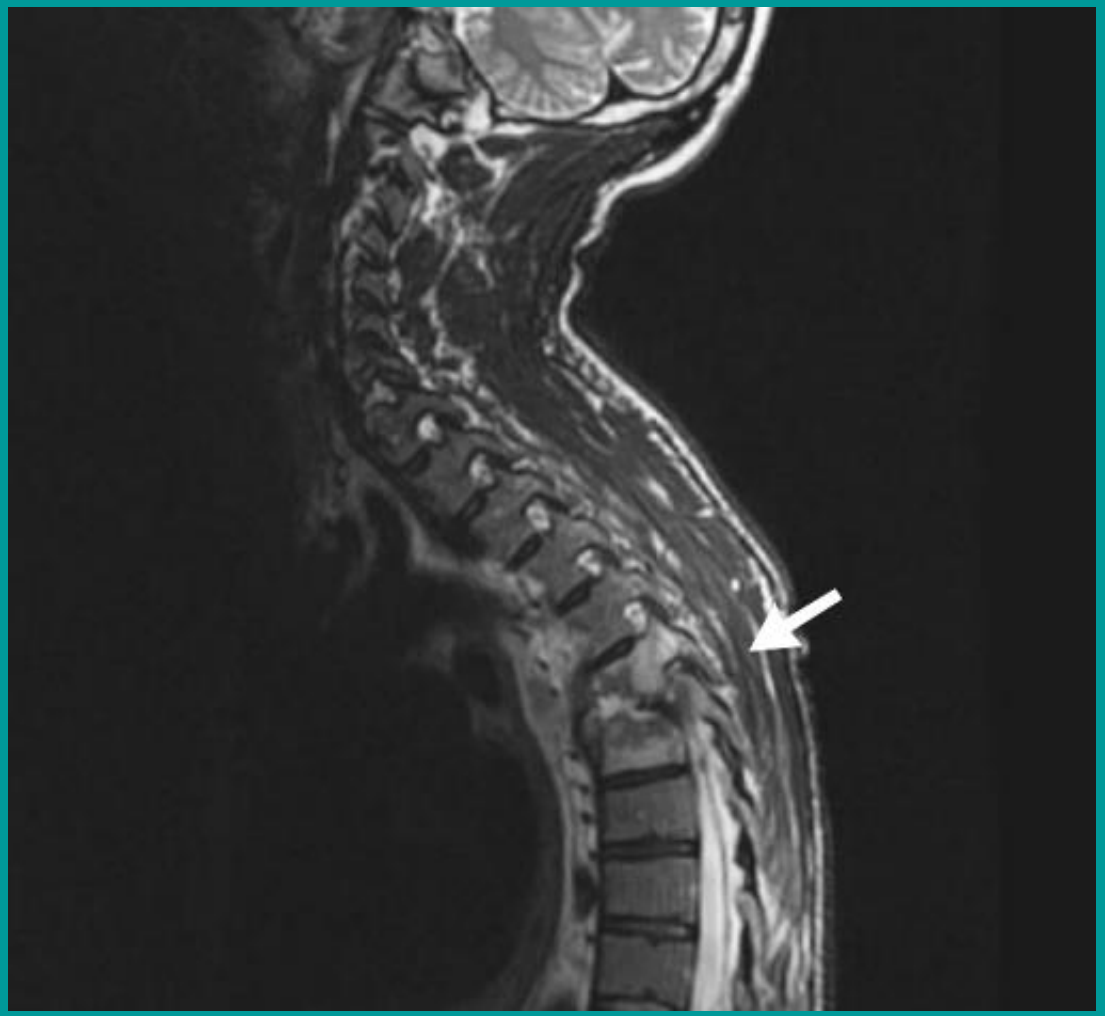
- Look for vertebral osteomyelitis
- Negative for osteomyelitis in spine

Gordon, Rachel and Franklin Lowy. Bacterial Infections in Drug Users. *NEJM.* 2005; 353, 18: 1945-1954.

Beth Israel Deaconess Medical Center
Greg Haman, HMS III
Gillian Lieberman, MD

Companion Patient 4: MRI spine

- T2-weighed MRI
- Sagittal view of an IV drug user with vertebral osteomyelitis involving T6–T7 (white arrow) with an adjacent epidural abscess.



Sagittal T2-weighed MRI Spine.

Gordon, Rachel and Franklin Lowy. Bacterial Infections in Drug Users. *NEJM.* 2005; 353, 18: 1945-1954.

Our Patient's Hospital Course

- JS improved slowly on IV vancomycin
- Discharged to rehab 21 days after admission
  - breathing comfortably on room air
  - afebrile for 24 hours
  - Continue to follow pt. with outpatient visits
  - Address JS's drug addiction

IE: Prognosis

- Mortality rates vary across sub-groups
  - Predictors of higher mortality include increased age, staph aureus infection, heart failure, cerebrovascular and embolic events
- In-hospital mortality rates of 15-22%
- 5 year mortality: 40%

Hoen, Bruno and Xavier Duval. Infective Endocarditis. *New England Journal of Medicine.* 2013; 368, 15: 1425-1433.

Summary Slide

- We have learned
  - Risk factors for IE
  - Physical exam stigmata of IE
  - Duke's criteria for diagnosis of IE
- Discussed the ACR criteria on the appropriate role of CXR and Echocardiography in the work up of IE
- Visualized common complications of IE on imaging
- Described these complications with terms appropriate to each modality including CT Abdomen, MRI Head, and MRI Spine

References

- ACR Appropriateness Criteria: Infective Endocarditis. Date of Origin: 1998. Last Review Date: 2011. Date Accessed: November 15, 2013. http://www.acr.org/~/media/ACR/Documents/AppCriteria/Diagnostic/SuspectedInfectiveEndocarditis.pdf
- Gordon, Rachel and Franklin Lowy. Bacterial Infections in Drug Users. *New England Journal of Medicine*. 2005; 353, 18: 1945-1954. Date Accessed: November 17,2013. http://www.nejm.org/doi/full/10.1056/NEJMra042823
- Hoen, Bruno and Xavier Duval. Infective Endocarditis. *New England Journal of Medicine*. 2013; 368, 15: 1425-1433. Date Accessed: November 17,2013. http://www.nejm.org/doi/full/10.1056/NEJMcp1206782
- Sexton, Daniel J. and Vance G. Fowler. Clinical Manifestations and diagnosis of infective endocarditis, Up To Date. Accessed: November 17, 2013. http://www.uptodate.com/contents/clinical-manifestations-and-diagnosis-of-infective-endocarditis
- Visualdx: substance abuse, skin popping. Accessed: November 17, 2013. http://see.visualdx.com/diagnosis/substance_abuse_skin_popping
- Rao, T. V. Infective Endocarditis: An Update. Accessed November 17, 2013. http://www.authorstream.com/Presentation/doctorrao-1857155-infective-endocarditis/
- Hess, A. and I. Klein, B. Iung, P. Lavalle´e, E. Ilic-Habensus, Q. Dornic, F. Arnoult, L. Mimoun, M. Wolff, X. Duval, and J.-P. Laissy. Brain MRI Findings in Neurologically Asymptomatic Patients with Infective Endocarditis. American Journal of Neuroradiology. 34: 1579-84. August, 2013. Accessed: November 17, 2013. http://www.ajnr.org/content/34/8/1579.abstract.
- Atilla, Ozge, Zeynep Temizyurek, and Egemen Kirman. Infective Endocarditis complicated with cerebral and splenic infarction in a hemodialysis patient. World Journal of Emergency Medicine. Accepted after revision July 20, 2013. Accessed November 17, 2013

Acknowledgements

- Our Patient, JS
- Dr. Mark Masciocchi
- Dr. Diana Litmanovich
- Dr. Gillian Lieberman