A POCUS Diagnosis

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PGY2, Internal Medicine

Patient History

- HPI: 57 yo man was sent to the ED from nephrology clinic on a Friday for Cr 3.2 from a baseline of 1.0.
  - 3 month history of progressive DOE, fatigue, 20 lb weight loss, and petechial rash.
  - Empiric trial of 30 mg prednisone started 3 weeks pta (for “non-specific rheumatologic condition”)
  - Referred to nephrology for microscopic hematuria and mild proteinuria
- ROS: Negative for f/c/s, arthralgias

Admission Physical Exam

- T 36.6, HR 79, BP 155/75, RR 18, SpO2 100%
- General: NAD
- HEENT: no oral lesions, clear conjunctiva, no LAD
- Cardiac: RRR, III/VI systolic murmur→axilla
- Pulm: bibasilar crackles
- Abd: benign
- Ext: Trace LLE edema (chronic)
- Neuro: alert, non-focal
- Skin: non-blanching petechial lesions and some papules over b/l lower extremities and torso

Notable Outpatient Workup

- Hgb 11.4→8.9
- WBC 8.1 (87.6% neutrophils)
- Plt 178
- Cr 1.0, BUN 17
- UA: 3+ blood, 1+ protein, 3-10 rbcs/hpf
- Prot/Cr ratio 486 mg/g
- C3 and C4 wnl
- ESR 65, CRP 8.2, Ferritin 632
- RF 15→23
- Weakly positive LA
- CXR, PETCT, stress test unremarkable
- TTE: mild to mod MR with mod prolapse of the anterior MV leaflet
- Petechiae biopsy: folliculitis
- PFTs: mild restrictive pattern

Notable Admission Labs

	Outpatient	Admission
Cr	1.0	3.4
BUN	17	77
UA	3-10 rbcs/hpf	50 rbcs/hpf
C3	118	74
C4	25	15
RF	15→23	27
BNP		670

	Outpatient	Admission
Hgb	11.4→8.9	8.4
WBC (%PMN)	8.1 (87.6)	13.3 (96)
Plt	178	138
Haptoglobin		<6
LDH		291
Bilirubin		0.8
%Retics		1.35
INR		1.0
PTT		26.8
Fibrinogen		366
D-dimer		229
Peripheral Smear		1+ schistocytes, 1+ burr cells

Working Diagnosis?

- RPGN, likely 2/2 ANCA-negative vasculitis
  - Renal consulted
  - Started on pulse dose steroids (1000 mg IV methylprednisolone q24h)
  - Plan for biopsy on Monday
- Also concern for TTP or other TMA
  - Hematology consulted
  - 2 units FFP given
  - Possible plasma exchange in AM

But then…POCUS

Parasternal Long Axis

Apical 4 Chamber

Apical 4 Chamber

MR

POCUS changed management

- Blood cultures were ordered
- Cardiology fellow was called for a weekend TTE

Official TTE: Apical 4 Chamber

Official TTE: Apical 2 Chamber

Official TTE: Apical 2 Chamber

Gram Positive Cocci in Chains

- Growth detected on day 1 (day 3 of hospitalization)
- 5/6 bottles positive
- Rapid diagnostic PCR panel ruled out *Staphylococcus spp.*, *Enterococcus spp.*, *S. pyogenes*, *S. agalactiae*, *S. pneumoniae*
- Patient started on IV ceftriaxone
- Final ID: *Streptococcus mutans*

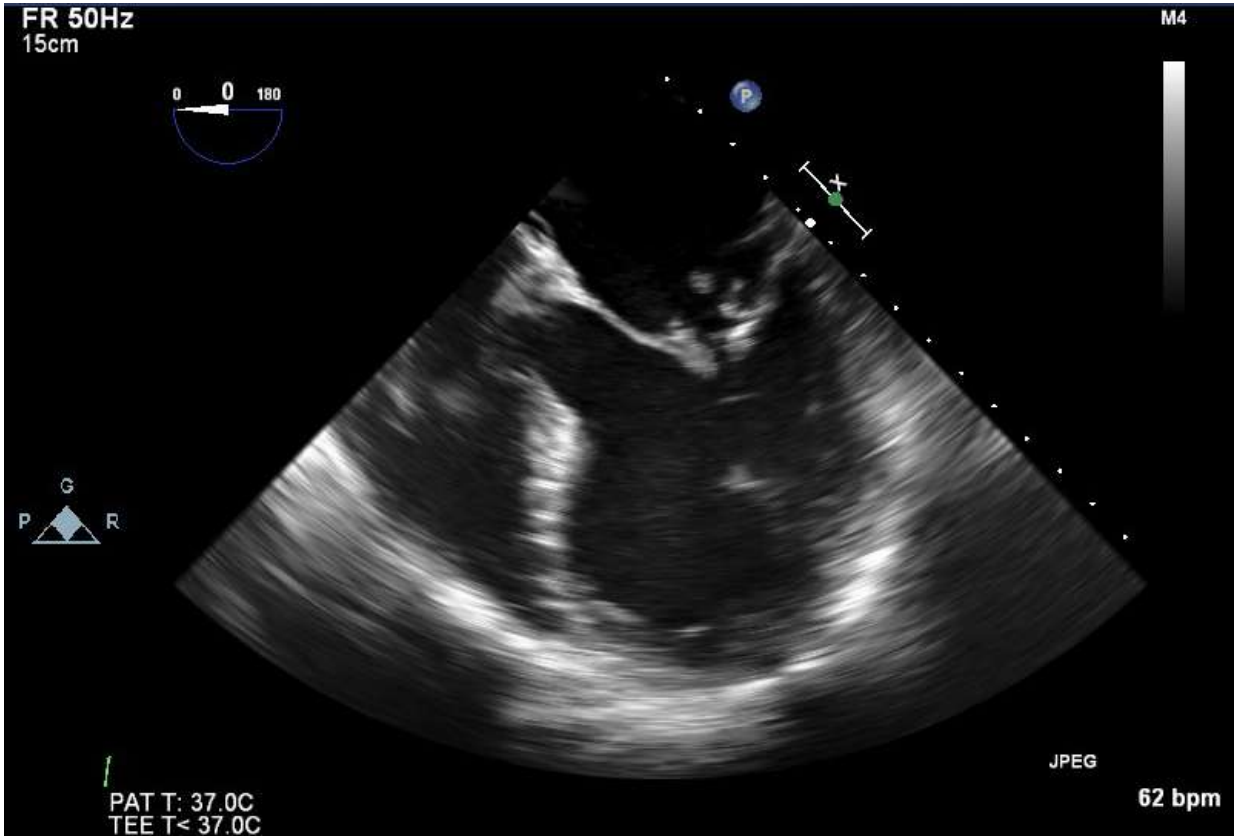
Official TTE Report

- Late systolic billowing of both leaflets c/w MVP
- Flail segment vs. vegetation on the posterior mitral leaflet and thickening vs. vegetation on the ventricular side of both leaflets.
- Moderate mitral regurgitation.
- Severe pulmonary hypertension.

New Diagnosis?

- Subacute infective endocarditis
  - Complicated by glomerulonephritis
  - Complicated by heart failure 2/2 mitral regurgitation
- How did management change?
  - Antibiotics started
  - Diuresis started
  - Steroids tapered more rapidly

Official TEE



How good is POCUS at detecting vegetations?

- Not a lot of data
- 6 Case Reports from EM literature
- What about TTE?

TTE vs. TEE

Study	Number of Patients	LR(TTE+)	LR(TTE-)	LR(TEE+)	LR(TEE-)
Shapiro et al, 1994	64	6.6	0.44	9.6	0.14
Erbel et al, 1988	96	31.5	0.37	50	0
Shively et al, 1991	66	22	0.67	Infinity	0.06
Pederson et al, 1991	24	7.1	0.54	Infinity	0
Kini et al, 2010	486	2.1	0.69	N/A	N/A

Size Matters

- TTE has better sensitivity to detect larger vegetations
  - Erbel et al, 1988
    - <5 mm: 0.25
    - 6-10 mm: 0.69
    - >11 mm: 1.0
  - Shapiro et al, 1994
    - <1 cm: 0.42
    - ≥1 cm: 0.82
- Vegetations >10 mm are more likely to embolize
  - Mugge, Andreas, Werner G. Daniel, Gunter Frank, and Paul R. Lichtlen. "Echocardiography in Infective Endocarditis: Reassessment of Prognostic Implications of Vegetation Size Determined by the Transthoracic and the Transesophageal Approach." *Journal of the American College of Cardiology* 14.3 (1989): 631-38. Web. 19 Apr. 2017.

Diagnosis of Infective Endocarditis

- Duke Criteria
  - Definite or Possible Endocarditis
    - LR+ 14
    - **LR- 0.01**
  - Definite Endocarditis Only
    - **LR+ 76**
    - LR- 0.24

Halpern, Scott D., Elias Abrutyn, and Brian L. Strom. "Infective Endocarditis."*Evidence-based Infectious Diseases*. 2nd ed. Hoboken, NJ: BMJ/Wiley-Blackwell, 2009. 75-86. 2011. Web. 17 Apr. 2017.

Duke Criteria

Li, J. S., D. J. Sexton, N. Mick, R. Nettles, V. G. Fowler, T. Ryan, T. Bashore, and G. R. Corey. "Proposed Modifications to the Duke Criteria for the Diagnosis of Infective Endocarditis." *Clinical Infectious Diseases* 30.4 (2000): 633-38. Web. 19 Apr. 2017.

Definite infective endocarditis

Pathologic criteria

(1) Microorganisms demonstrated by culture or histologic examination of a vegetation, a vegetation that has embolized, or an intracardiac abscess specimen; or

(2) Pathologic lesions; vegetation or intracardiac abscess confirmed by histologic examination showing active endocarditis

Clinical criteria[a]

(1) 2 major criteria; or

(2) 1 major criterion and 3 minor criteria; or

(3) 5 minor criteria

Possible infective endocarditis

(1) **1 major criterion and 1 minor criterion**; or

(2) **3 minor criteria**

Rejected

(1) Firm alternate diagnosis explaining evidence of infective endocarditis; or

(2) Resolution of infective endocarditis syndrome with antibiotic therapy for ≤4 days; or

(3) No pathologic evidence of infective endocarditis at surgery or autopsy, with antibiotic therapy for ≤4 days; or

(4) Does not meet criteria for possible infective endocarditis, as above

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[a] See table 4 for definitions of major and minor criteria.

Major criteria

Blood culture positive for IE

Typical microorganisms consistent with IE from 2 separate blood cultures:

Viridans streptococci, *Streptococcus bovis*, HACEK group, *Staphylococcus aureus;* or

Community-acquired enterococci, in the absence of a primary focus; or

Microorganisms consistent with IE from persistently positive blood cultures, defined as follows:

At least 2 positive cultures of blood samples drawn >12 h apart; or

All of 3 or a majority of ≥4 separate cultures of blood (with first and last sample drawn at least 1 h apart)

Single positive blood culture for *Coxiella burnetii* or antiphase I IgG antibody titer >1 : 800

Evidence of endocardial involvement

Echocardiogram positive for IE **(TEE recommended in patients with prosthetic valves, rated at least "possible IE" by clinical criteria, or complicated IE [paravalvular abscess]; TTE as first test in other patients)**, defined as follows :

Oscillating intracardiac mass on valve or supporting structures, in the path of regurgitant jets, or on implanted material in the absence of an alternative anatomic explanation; or

Abscess; or

New partial dehiscence of prosthetic valve

New valvular regurgitation (worsening or changing of pre-existing murmur not sufficient)

Minor criteria

Predisposition, predisposing heart condition or injection drug use

Fever, temperature >38°C

Vascular phenomena, major arterial emboli, septic pulmonary infarcts, mycotic aneurysm, intracranial hemorrhage, conjunctival hemorrhages, and Janeway's lesions

Immunologic phenomena: glomerulonephritis, Osler's nodes, Roth's spots, and rheumatoid factor

Microbiological evidence: positive blood culture but does not meet a major criterion as noted above[a] or serological evidence of active infection with organism consistent with IE

Echocardiographic minor criteria eliminated

NOTE. TEE, transesophageal echocardiography; TTE, transthoracic echocardiography.

[a] Excludes single positive cultures for coagulase-negative staphylococci and organisms that do not cause endocarditis.

Epilogue

- TEE confirmed vegetation, concern for chordae rupture, 4+ MR, new 1-2+ AR, Lambl's excrescence noted on AV
- Cultures rapidly cleared
- MRI brain: septic emboli, SAH (?mycotic aneurysm)
- Surgery delayed due to intracranial bleeding risk
- Renal pathology: immune complex mediated glomerulonephritis containing mainly polyclonal IgA, IgM, and C3 deposits (no crescents)
- Creatinine slowly improving (3.4→2.3)
- Patient discharged on hospital day #10 on IV CTX and steroid taper
- Readmitted same day with R MCA stroke 2/2 MCA occlusion, went emergently to interventional neuroradiology, NIHSS 18→0 s/p embolectomy
- Repeat TTE: mild AI with possible aortic valve vegetation

Epilogue continued

- Successful surgery on hospital day #4 (of second admission)
  - MV infected with torn chordae and significant fibrinous material, s/p excision
  - S/p bioprosthetic MVR
  - AV with 5 mm excrescence, s/p debridement
  - PFO closure
- Surgical pathology/microbiology:
  - MV with fibrosis and extensive acute and chronic inflammation and necrosis consistent with acute endocarditis. Gram stain shows numerous GPCs in pairs and short chains. NGTD.
  - AV lesion with necrotic material and focal inflammatory cells, positive for bacteria, consistent with vegetation. Gram stain shows numerous GPCs in pairs and short chains. NGTD.
- Doing well. Transferred to from 4W to 4C on hospital day #9 (POD #5), with plan for acute rehab
- Cr down to 1.3

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