
BRIGHAM HEALTH
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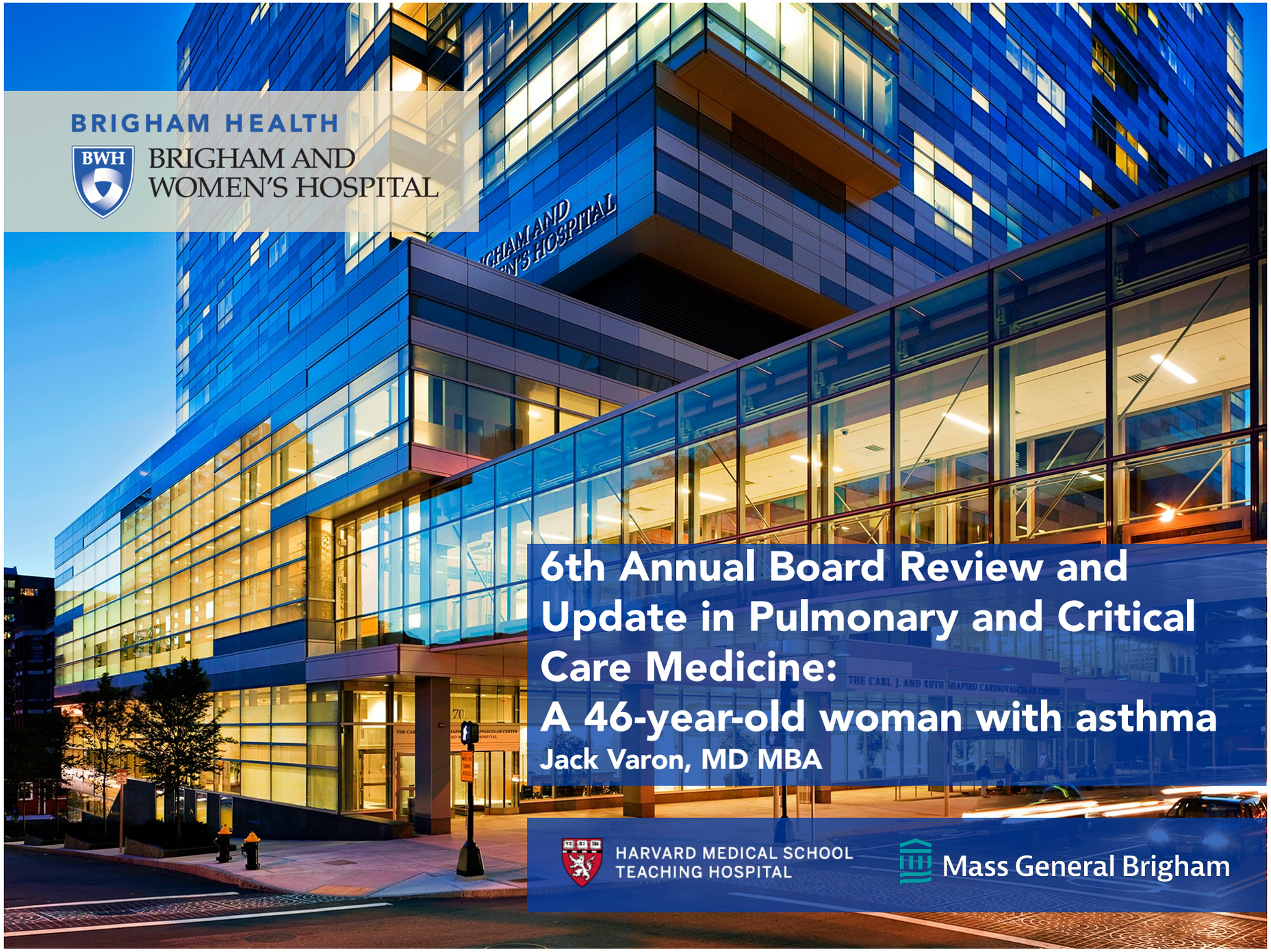
BRIGHAM AND
WOMEN'S HOSPITAL
Best MICU Cases 2021
6th Annual Board Review and Update in Pulmonary and Critical Care Medicine
Anthony Massaro, MD
Medical Director, Medical ICU
Brigham and Women's Hospital
Boston, MA
HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL
Mass General Brigham

	Presenter	Case
7:30	Jack Varon MD	46 y.o. woman with asthma
7:50	Benjamin Atkinson MD	65 y.o. male with lower extremity weakness
8:10	Bradley Martin MD	62 y.o. woman with shock
8:30	Anthony Massaro MD	60 y.o. woman with acute on chronic respiratory failure
8:50	Marjorie Elizabeth Bateman MD	24 y.o. woman with SLE and shock
9:10	Rachel Wood MD	34 y.o. woman with Covid Pneumonia in Pregnancy


BRIGHAM HEALTH
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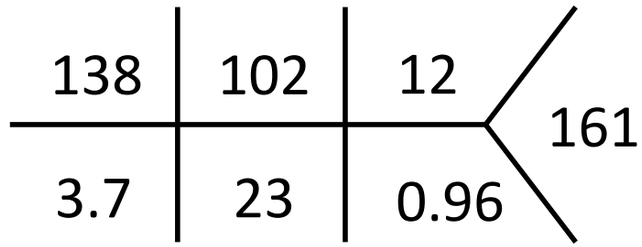
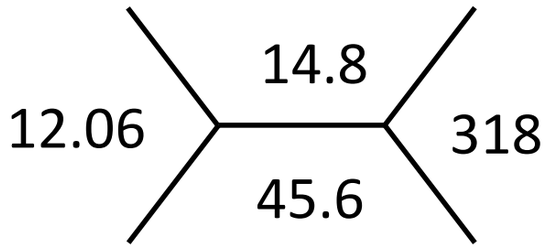
WOMEN'S HOSPITAL
6th Annual Board Review and Update in Pulmonary and Critical Care Medicine:
A 46-year-old woman with asthma
Jack Varon, MD MBA
HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL
Mass General Brigham

Initial Presentation

- 46-year-old woman presents to the emergency department with two days of progressive dyspnea
- She has a history of asthma that has generally been well controlled with inhaled fluticasone, with albuterol as needed. She has never been intubated or hospitalized for her asthma.
- Over the last few months, she has been unable to use fluticasone due to problems with insurance and has been using albuterol more frequently.
- She has a history of anxiety.
- No recent travel. No sick contacts.
- On presentation she is afebrile, HR 122, BP 135/94, RR 39, SaO_2 70% on room air → 98% on 15 L via face mask
- She is respiratory distress, diaphoretic, speaking in two-word sentences, in the tripod position with accessory muscle use.
- This is diffuse wheezing on chest auscultation.

Diagnostics

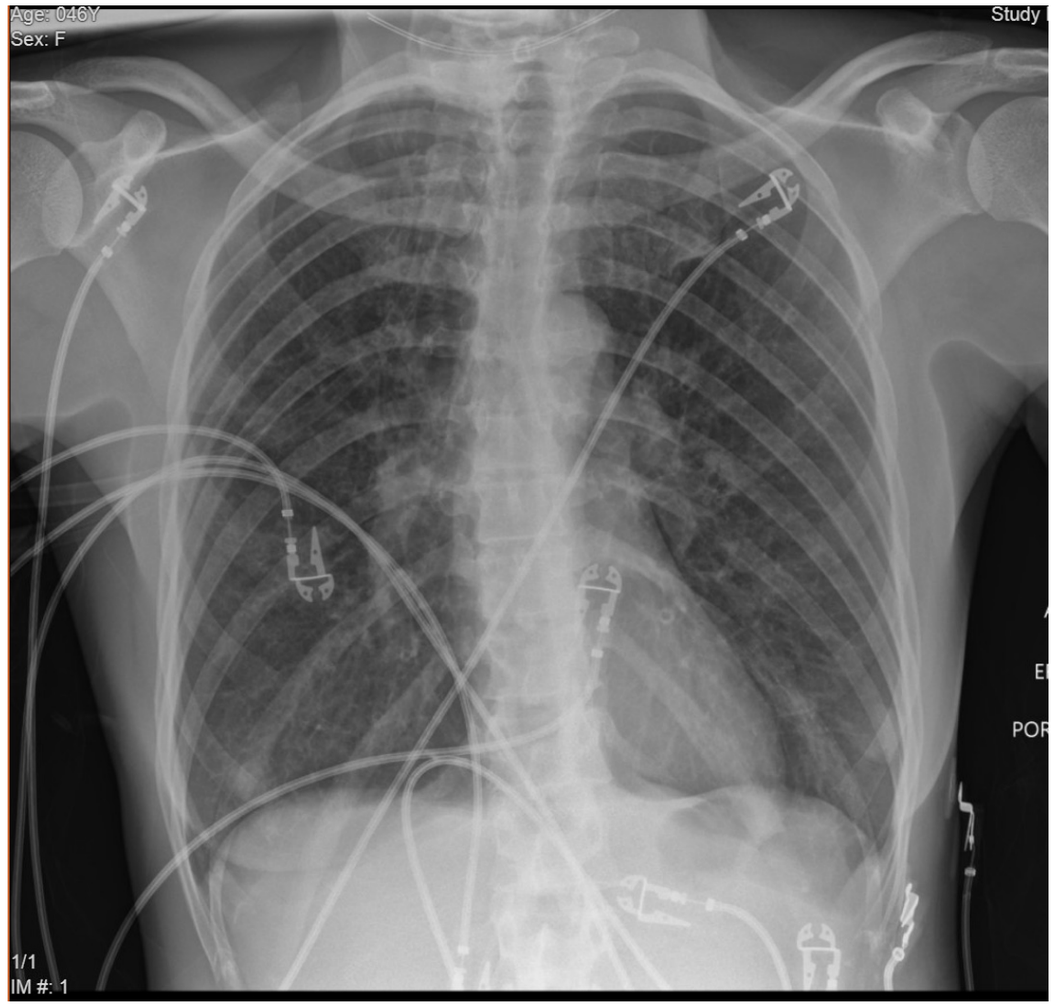




VBG=7.25/60

Troponin T-hs < 6

SARS-COV2 PCR negative



What are priorities in her management?

- ED physicians attempt to start the patient on NIPPV, but she is unable to tolerate it due to anxiety
- Placed her on high flow nasal cannula
- Started on:
  - Albuterol via continuous nebulization
  - Solumedrol IV 125 mg
  - Terbutaline SC 0.25 mg
  - Azithromycin IV 500 mg
  - Magnesium Sulfate IV 2 mg
- On these therapies, VBG changes from 7.25/60 to 7.30/50

Clinical course

- Waits in the Emergency Department for several hours for intensive care unit bed availability
- On arrival to the MICU, ABG is 7.24/52/80 on 30% FiO2 via HFNC
- She is still tachypneic to 40 BPM, with 2- to 3-word responses, tripoding, and accessory muscle use.
- She continues to refuse NIPPV due to anxiety
- **What is the best next step in her management?**

What is the best next step in her management?

A) Intubate now

B) Treat anxiety and attempt another trial with non-invasive positive pressure ventilation

C) Continue high flow nasal cannula while waiting for medical therapy to have an effect

D) Other

What is the best next step in management?

A) Attempt bronchoscopy to look for proximal obstruction

B) Initiate biologic therapy (ie omalizumab, mepolizumab, etc)

C) Change ventilator settings

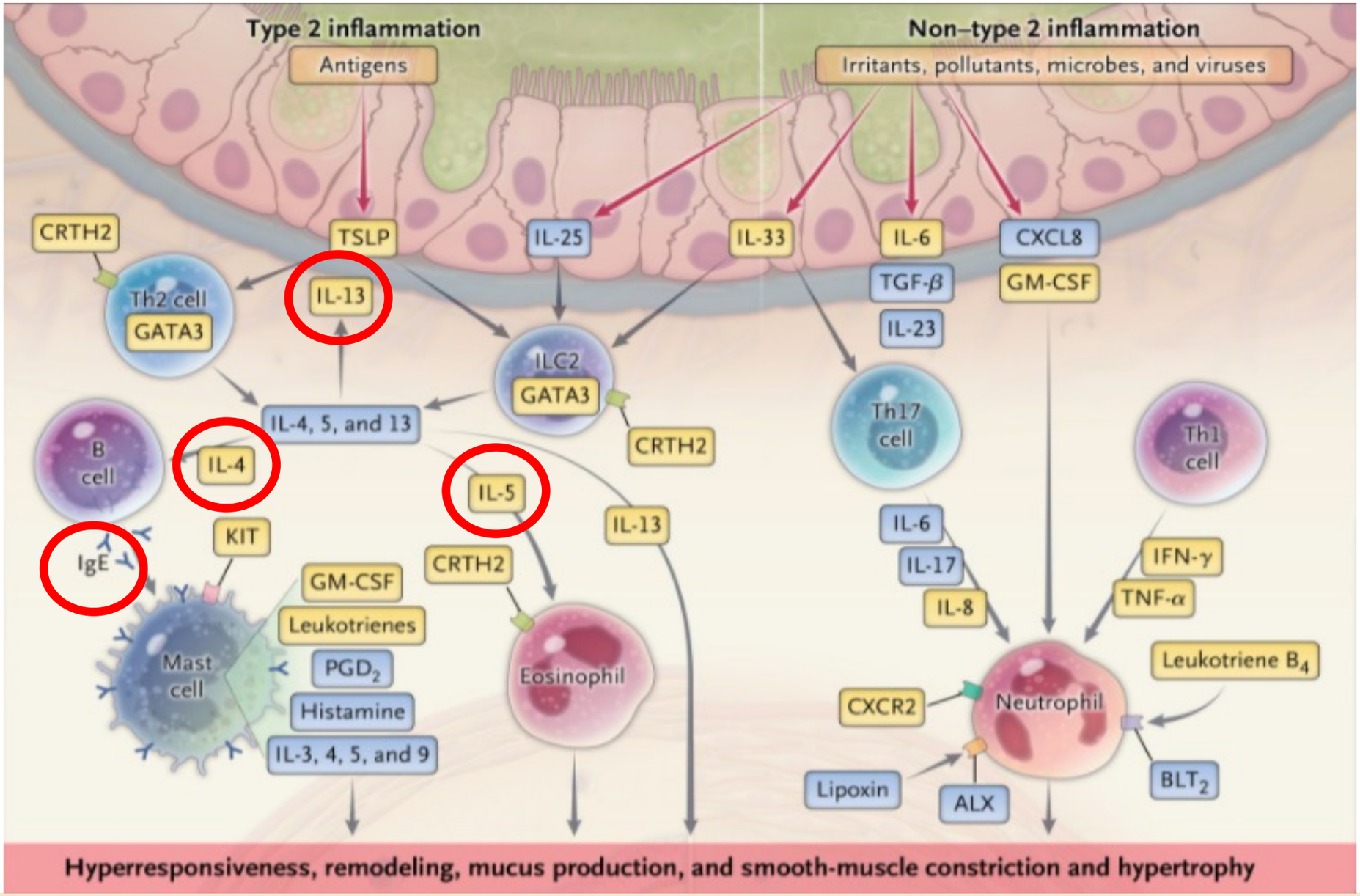
D) Consult Extracorporeal membrane oxygenation (ECMO) team

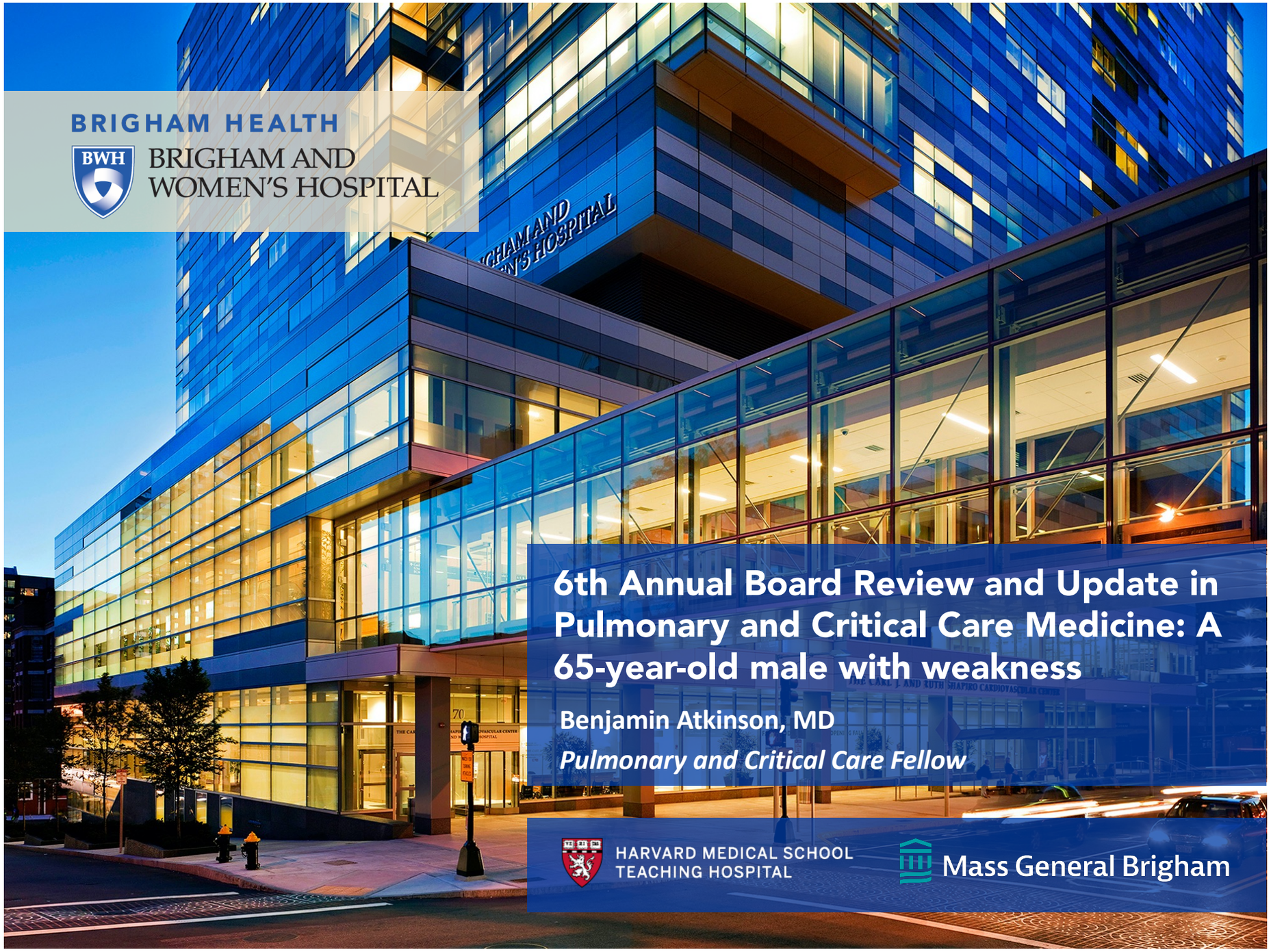
What study will be most helpful in her management?

A) Eosinophil count prior to corticosteroids
B) BAL fluid counts
C) Total IgE
D) CT scan
E) Aspergillus IgE/IgG

What is at the top of your differential?

A) Severe atopic asthma
B) Severe eosinophilic asthma
C) Allergic bronchopulmonary aspergillosis (ABPA)
D) More than one of A, B, or C
E) None of the above


Type 2 inflammation
Antigens
Non–type 2 inflammation
Irritants, pollutants, microbes, and viruses
CRTH2
TSLP
IL-25
IL-33
IL-6
CXCL8
TGF-β
GM-CSF
IL-23
Th2 cell
GATA3
IL-13
ILC2
GATA3
CRTH2
Th17 cell
Th1 cell
IL-4, 5, and 13
B cell
IL-4
IL-5
IL-13
IL-6
IL-17
IL-8
IFN-γ
TNF-α
IgE
KIT
CRTH2
GM-CSF
Leukotrienes
PGD2
Histamine
IL-3, 4, 5, and 9
Mast cell
Eosinophil
Neutrophil
Leukotriene B4
CXCR2
Lipoxin
ALX
BLT2
Hyperresponsiveness, remodeling, mucus production, and smooth-muscle constriction and hypertrophy


BRIGHAM HEALTH
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WOMEN'S HOSPITAL
6th Annual Board Review and Update in Pulmonary and Critical Care Medicine: A 65-year-old male with weakness
Benjamin Atkinson, MD
Pulmonary and Critical Care Fellow
HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL
Mass General Brigham

HPI

- 65 y.o. male noted acute onset mid back pain 5 days prior to presentation.
- Pain was severe and focal in the mid-low back, without radiation
- There was no inciting trauma or fall prior to symptom onset
- One day after the onset of these symptoms, the patient endorsed progressive pain and significant leg weakness, which resulted in an inability to stand

Extended HPI

- Weakness and pain progressed, with patient noting that he became unable to walk without being supported
- He noted some tingling of the bilateral hands 24 hours prior to presentation, without additional UE symptoms
- One week prior, he was able to play a round of golf without issue
- He received his COVID booster roughly 2 weeks prior to symptom onset

PAST MEDICAL HISTORY

CPFE s/p bilateral lung transplant, 6/2020

-CMV D+/R-, EBV D+/R+, Toxo D-/R-

-No prior episodes of rejection

-Right hemidiaphragm paresis

Short telomere syndrome

HTN

GERD

-Nissen fundoplication in 1/2021

DM2

Hodgkin lymphoma

-Diagnosed 2009, treated with chemotherapy, in remission

SOCIAL HISTORY

Lives with his wife in CT. Previously worked in a warehouse. Remains physically active with only mild dyspnea. Former smoker, 10 pack years, quit in 1990s. No notable exposures.

FAMILY HISTORY

Mother with IPF. Otherwise unremarkable.

MEDICATIONS

Tacrolimus

Azathioprine

Prednisone 5 mg

Atovaquone

Chelated magnesium

Lokelma

Metoprolol succinate 100 mg

Pravastatin

Pioglitazone

Escitalopram

VS: T 36.9 (98.5) HR 72 BP 187/103 RR 16 SaO2 97% (RA)

Gen: uncomfortable appearing, but no distress, grimaces in pain with movement
CV: RRR, no murmurs, JVP < 10
Pulm: Clear bilaterally, normal work of breathing
Ext: no edema
Back: Point tenderness over lower thoracic spine

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Back: Point tenderness over lower thoracic spine

Neurologic Exam HD1

- CN 2-12 intact
- Strength: Exam limited by pain
  - Shoulder abduction LUE 5/5, Proximal RUE 2/5 (reportedly chronic 2/2 shoulder injury)
  - Bilateral elbow flexion/extension 4/5, Bilateral wrist flexion 5/5
  - Bilateral hip flexion 3/5, Bilateral knee flexion/extension 4/5
  - Bilateral ankle plantar/dorsiflexion 5/5
- Sensation diffusely intact to light touch and pinprick
- Reflexes:
  - 2+ DTRs at biceps and quadriceps, 1+ at gastrocnemius/soleus

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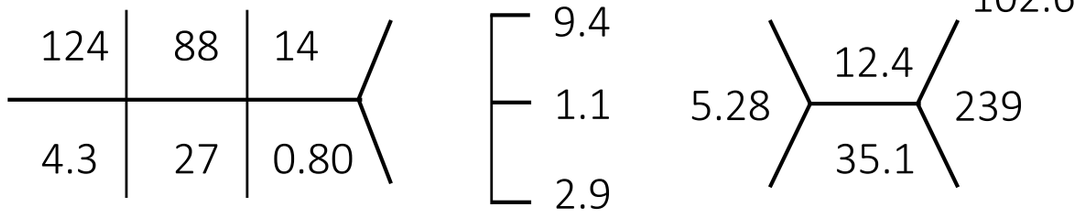
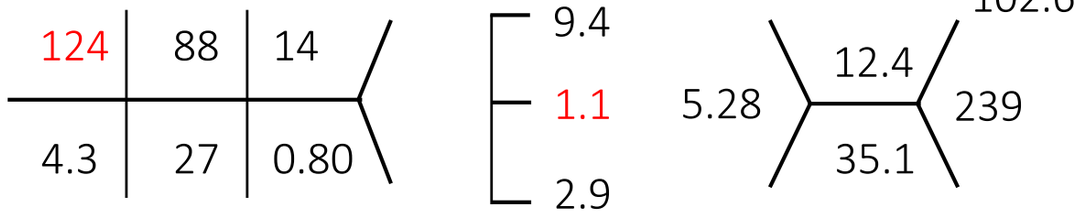


Diff: 62% neuts, 26% lymphs

Total protein 9.1
Albumin 4.4
LFTs wnl

Urine sodium 126
Urine osmolality 518



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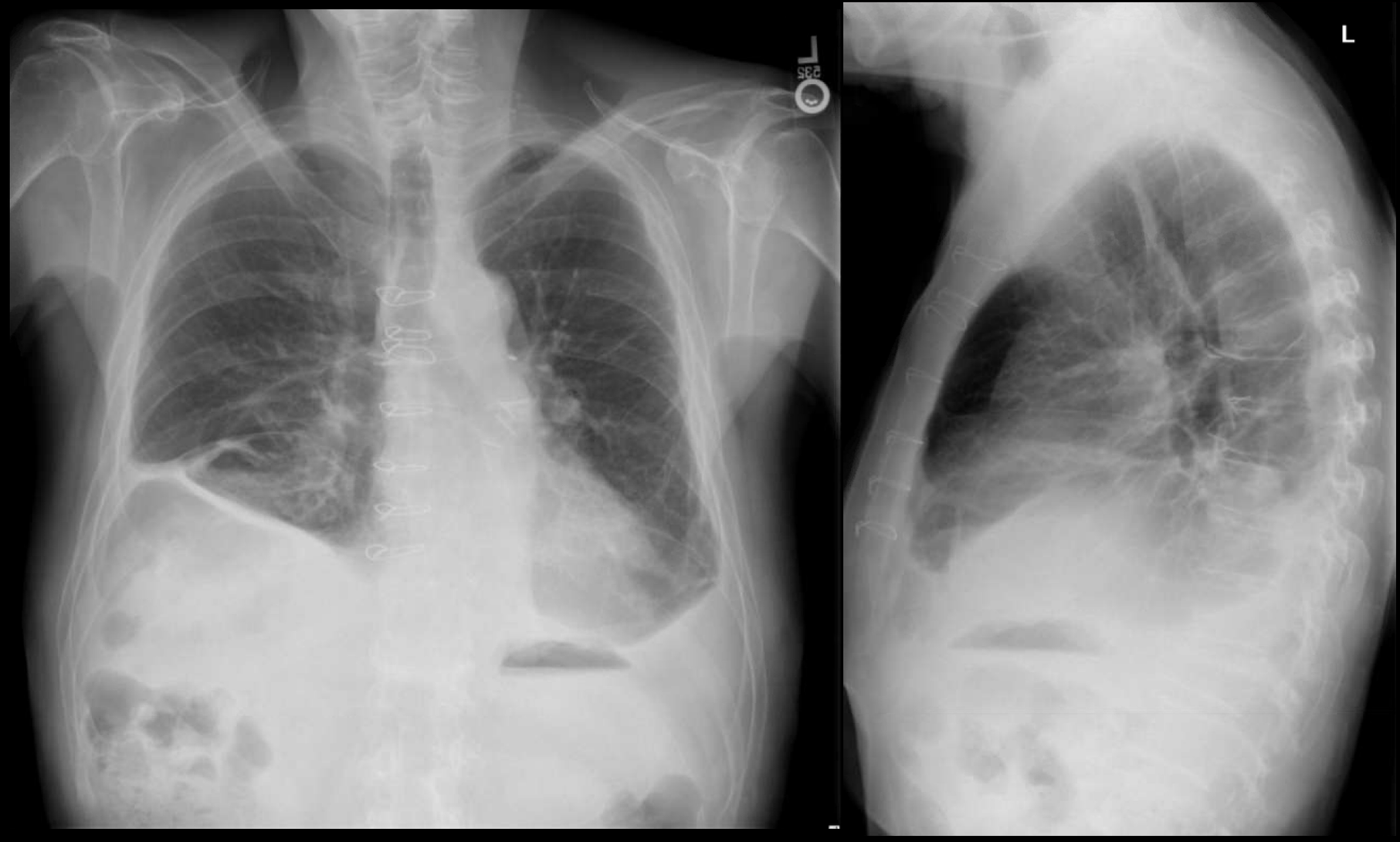
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65 y.o. male with a history of BOLT in 6/2020, GERD and HTN who is admitted with back pain, severe hypertension, electrolyte disarray, symmetric, lower extremity predominant, proximal greater than distal muscle weakness, and mild hyporeflexia.

What is highest on your differential diagnosis?

A. Primary CNS or spinal cord pathology i.e. stroke, CNS infection, myelitis, spinal cord injury
B. Electrolyte disarray
C. Polyneuropathy
D. Myopathy
E. Neuromuscular junction disorder

What is your next diagnostic step?

A. Brain and spine imaging
B. Electromyography and nerve conduction studies
C. Lumbar puncture
D. Creatinine kinase (CK)
E. No diagnostics until electrolytes corrected

What is your next diagnostic step?

A. Electromyography and nerve conduction studies
B. Lumbar puncture
C. Creatinine kinase (CK)
D. Other diagnostic not listed
E. No diagnostics until electrolytes corrected


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WOMEN'S HOSPITAL
61 year-old woman with 2-weeks of worsening abdominal pain
Bradley Martin MD
HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL
A FOUNDING MEMBER OF PARTNERS HEALTHCARE

Initial Presentation

- 61 year old woman presents to the emergency department with two weeks of abdominal pain.
- Pain was previously localized to the RUQ, intermittent in nature without clear provoking factors.
- This morning, she was finishing a 12-hour shift (she is an RN), when the pain acutely worsened – it is now 9/10, diffuse, unremitting.
- Worsening pain accompanied by episode of self-limited nausea w/ non-bloody non-bilious emesis.
- During nursing report, a coworker noted that she appeared “jaundiced”.

History

- Known medical history is limited to hypertension, hyperlipidemia, hyperthyroidism, diabetes mellitus.
- No new prescription medications or OTCs.
- Chronic medications: Metoprolol, Lisinopril, Insulin glargine, Methimazole
- No travel or known occupational exposures.

Initial Presentation

Physical Exam:

BP 95/45 | Pulse 100 | Temp 36.6 °C (97.9 °F) (Temporal) | Resp 18 | Ht 157.5 cm (5' 2") | Wt 99.8 kg (220 lb) | SpO2 100% | BMI 40.24 kg/m²
GENERAL: Awake and alert. Uncomfortable appearing. In mild distress
SKIN: Warm & Dry, no rash, no bruising.
HEAD: Atraumatic. PERRL. Oropharynx no tonsillar erythema or exudates. TM's pearly gray with normal landmarks. Scleral icterus is noted.
NECK: Supple, no midline tenderness.
LUNGS: Clear to auscultation bilaterally without rales, rhonchi or wheezing.
HEART: Tachycardic. Regular rhythm. No murmurs, rubs, or gallops.
ABDOMEN: Soft, flat, without distension. Diffusely tender to palpation. No rebound or guarding.
MUSCULOSKELETAL: No deformities. Well-perfused extremities. No cyanosis or edema.
GENITOURINARY: No CVA tenderness.
BACK: Nontender.
NEUROLOGIC: Normal speech. Alert & oriented x 3, CNsII-XII intact. Gait normal. Motor function 5/5 bilaterally. Sensation to touch intact throughout.
PSYCHIATRIC: Normal affect

Initial Diagnostics

1304

Lactic acid (mmol/L)(!): 14.6 [MB]

1305 No EKG changes

Potassium(!): 5.6 [MB]

1306

Bilirubin (Total)(!): 10.1 [MB]

1306

PT-INR(!): 2.1 [MB]

1313

Creatinine(!): 2.60 [MB]

1313

Anion Gap(!): 29 [MB]

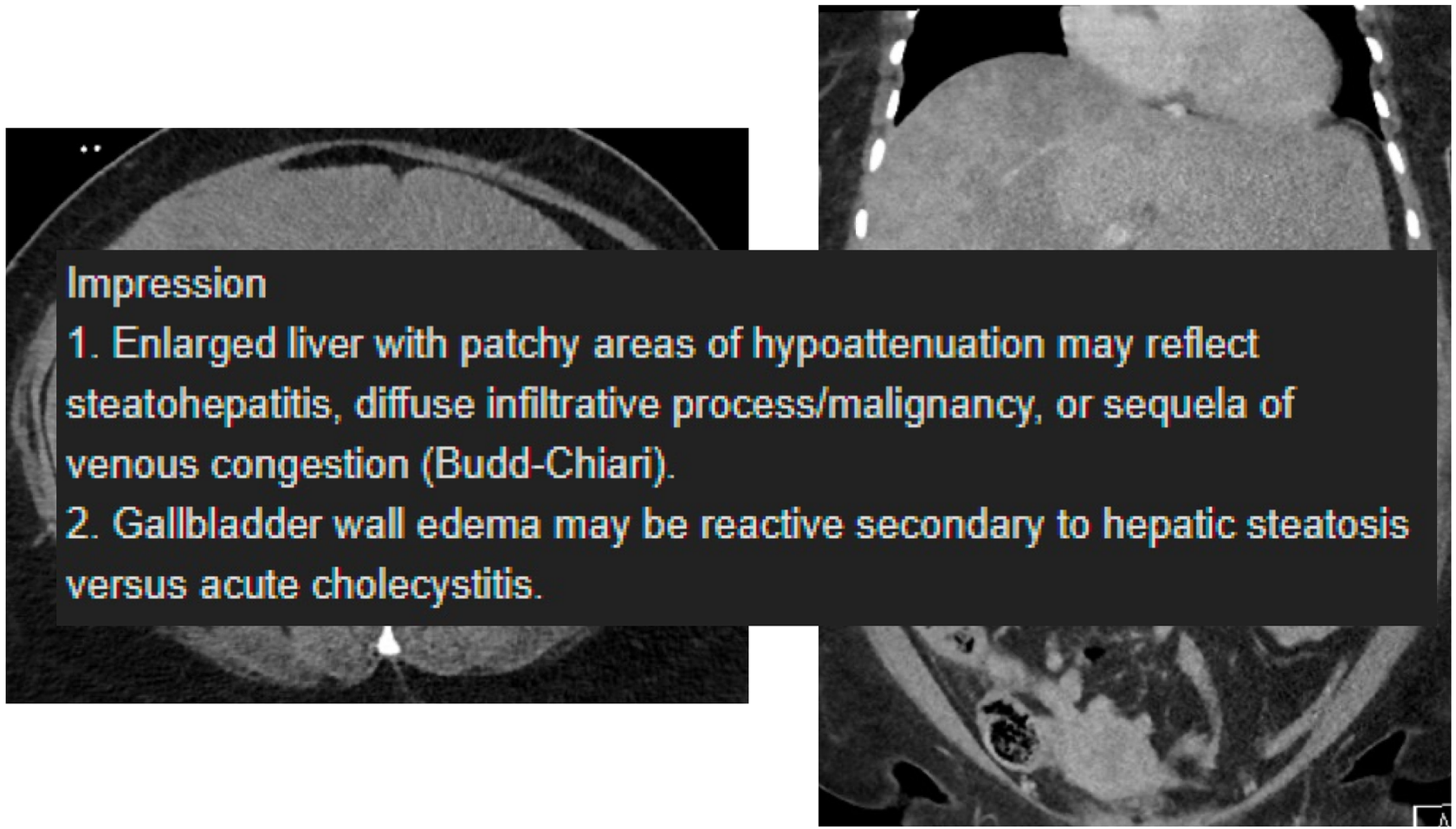
VBG = 7.26 / 27

Initial Diagnostics

WBC	4.00 - 10.00 K/uL	**34.97 (HH)**
RBC	3.90 - 6.00 M/uL	**3.67 (L)**
Hgb	11.5 - 16.4 g/dL	**8.2 (L)**
HCT	36.0 - 48.0 %	**26.3 (L)**
PLT	150 - 450 K/uL	248
MCV	80.0 - 100.0 fL	**71.7 (L)**
MCH	27.0 - 32.0 pg	**22.3 (L)**
MCHC	32.0 - 36.0 g/dL	**31.2 (L)**
RDW	11.5 - 14.5 %	**24.6 (H)**

Albumin	3.5 - 5.2 g/dL	**2.7 (L)**
Bilirubin (Total)	0.0 - 1.0 mg/dL	**10.1 (H)**
Bilirubin (Direct)	0.0 - 0.3 mg/dL	**8.2 (H)**
Alk Phos	35 - 130 U/L	**857 (H)**
AST (SGOT)	10 - 50 U/L	**1,725 (H)**
ALT (SGPT) (U/L)	10 - 50 U/L	**416 (H)**
Total Protein	6.4 - 8.3 g/dL	**7.4**
Globulin	2.2 - 4.2 g/dL	**4.7 (H)**

Initial Diagnostics



Initial management / course

- Receives 2L crystalloid + IV Zosyn
- A RUQ Ultrasound is ordered

- Following initial resuscitation:

Sodium	135 (L)	134 (L)
Chloride	94 (L)	94 (L)
Potassium	5.6 (H)	5.2 (H)
Carbon Dioxide	12 (LL)	10 (LL)
BUN	39 (H)	37 (H)
Creatinine	2.60 (H)	3.01 (H)
Glucose	66 (L)	58 (LL)
Calcium	8.8	8.4 (L)
GFR (estimated)	19 (L)	NOT CALC
Anion Gap	29 (H)	30 (H)

Albumin	2.7 (L)	2.3 (L)
Bilirubin (Total)	10.1 (H)	8.4 (H)
Bilirubin (Direct)	8.2 (H)	7.5 (H)
Alk Phos	857 (H)	750 (H)
AST (SGOT)	1,725 (H)	1,944 (H)
ALT (SGPT) (U/L)	416 (H)	358 (H)

Lipase (U/L)	28	
Lactic acid (mmol/L)	14.6 (H)	17.1 (H)
Acetaminophen	<5.0 (L)	

What etiologies are being considered in the differential diagnosis?

a) Acute Cholecystitis / Choledocholithiasis

b) Acute viral hepatitis

c) Budd-Chiari syndrome

d) Primary hepatobiliary malignancy

What is the best next step in management?

a) Place bolt for invasive ICP monitoring

b) Obtain CT Head

c) Administer empiric hyperosmolar therapy

d) Initiate neuromuscular blockade

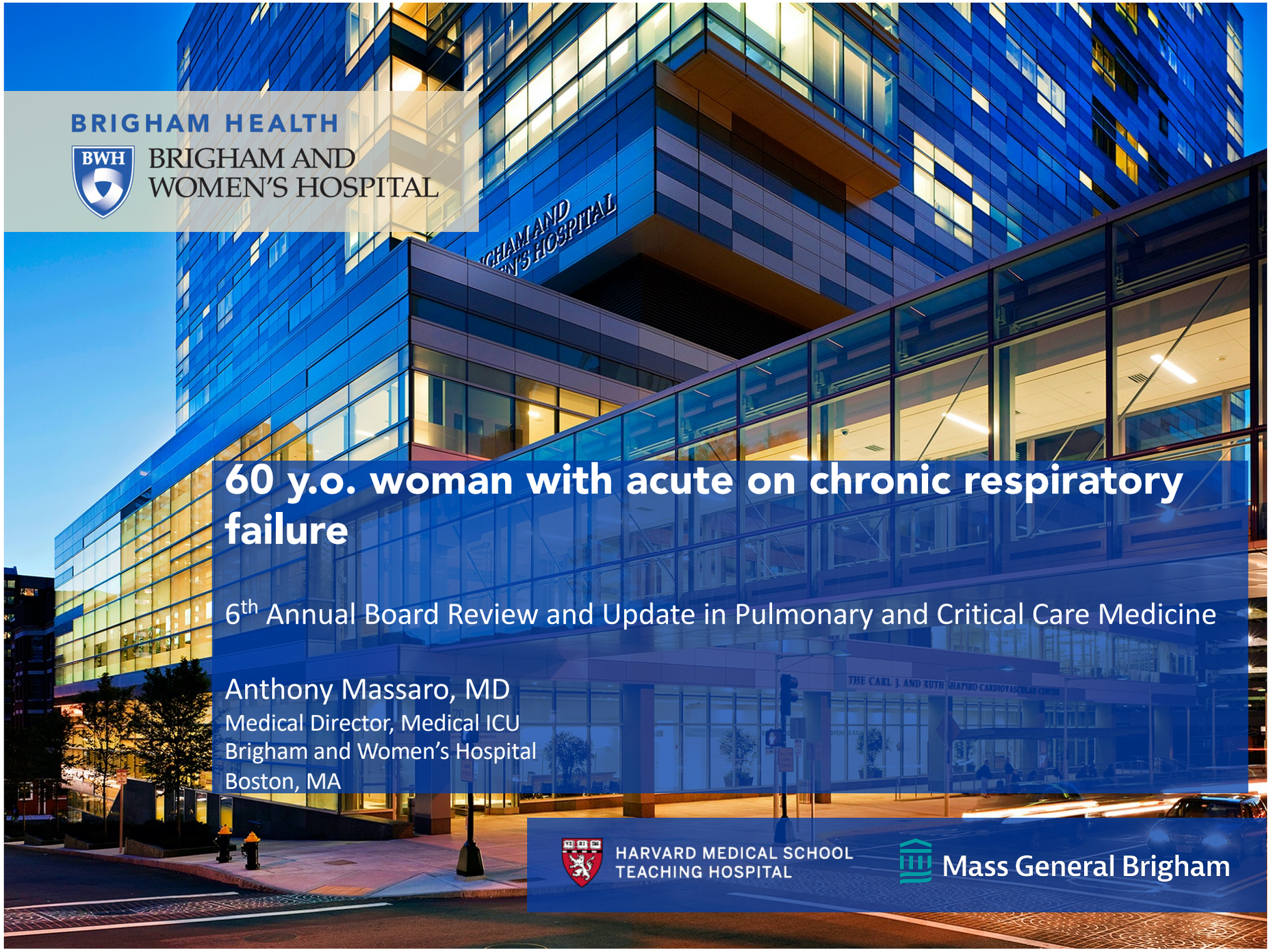
What is the best next step in management?

a) Obtain MRCP

b) Transfer to liver transplant center

c) Broaden antimicrobials to aminoglycoside + antifungal

d) Give methylene blue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60 y.o. woman with acute on chronic respiratory failure
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- 60 y.o. woman with Noonan syndrome and severe kyphoscoliosis admitted with acute on chronic respiratory failure with hypercapnia.
  - Lifetime nonsmoker
  - ASD repair in the past
  - 2019 acute respiratory failure with hypercapnia
    - O2 2-3L during day; CPAP at night
  - 2 weeks PTA Distal left radius fracture
- Sudden worsening of dyspnea on the evening prior to admission.
- Denies antecedent fever, chills, cough or sputum.
- Unable to connect CPAP machine to oxygen concentrator
- Called EMS
- ED Eval:
  - Tachypneic. Altered mental status. Lungs with bilateral rhonchi.
  - WBC=18.3 (82% Neutrophils), lactate=0.5. Procalcitonin 0.22 (o.00-0.08 ng/mL nl range) VBG 7.19/>101
  - Started on BiPAP support. Cultured and antibiotics initiated.

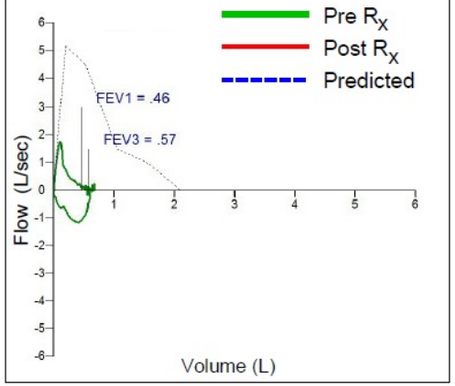
Exam (MICU)

- Severe kyphoscoliosis, pectus
- Awake, alert and reluctantly conversant
- No rashes
- JVP 12-15 cm
- Lungs clear on auscultation
- RRR S1,s2 with 3/6 crescendo, decrescendo murmur and short diastolic murmur at left upper sternal border
- Abdomen soft, nontender
- Extremities without clubbing, cyanosis or edema.

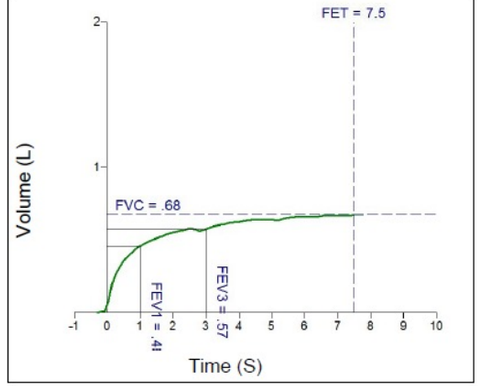
ATS compliant tests are indicated by a ✔ : FVC FRC DLCO VTG

Spirometry		Predicted Range Mean	Predicted Range 95%	Pre Bronchodilator Actual	Pre Bronchodilator % Pred
FVC Effort Time		----	----	14:01	----
FEV_1	L	1.77	1.21	0.46	26
FVC	L	2.11	1.43	0.68	32
FEV_1 / FVC	%	83	74	68	82
FEV_6	L	2.32	1.80	0.66	28
FEV_1 / FEV_6	%	81	72	69	85
FEF_{25-75}	L/s	2.16	0.80	0.25	12
PEFR	L/s	5.18	3.88	1.74	34

Flow Volume



Volume Time

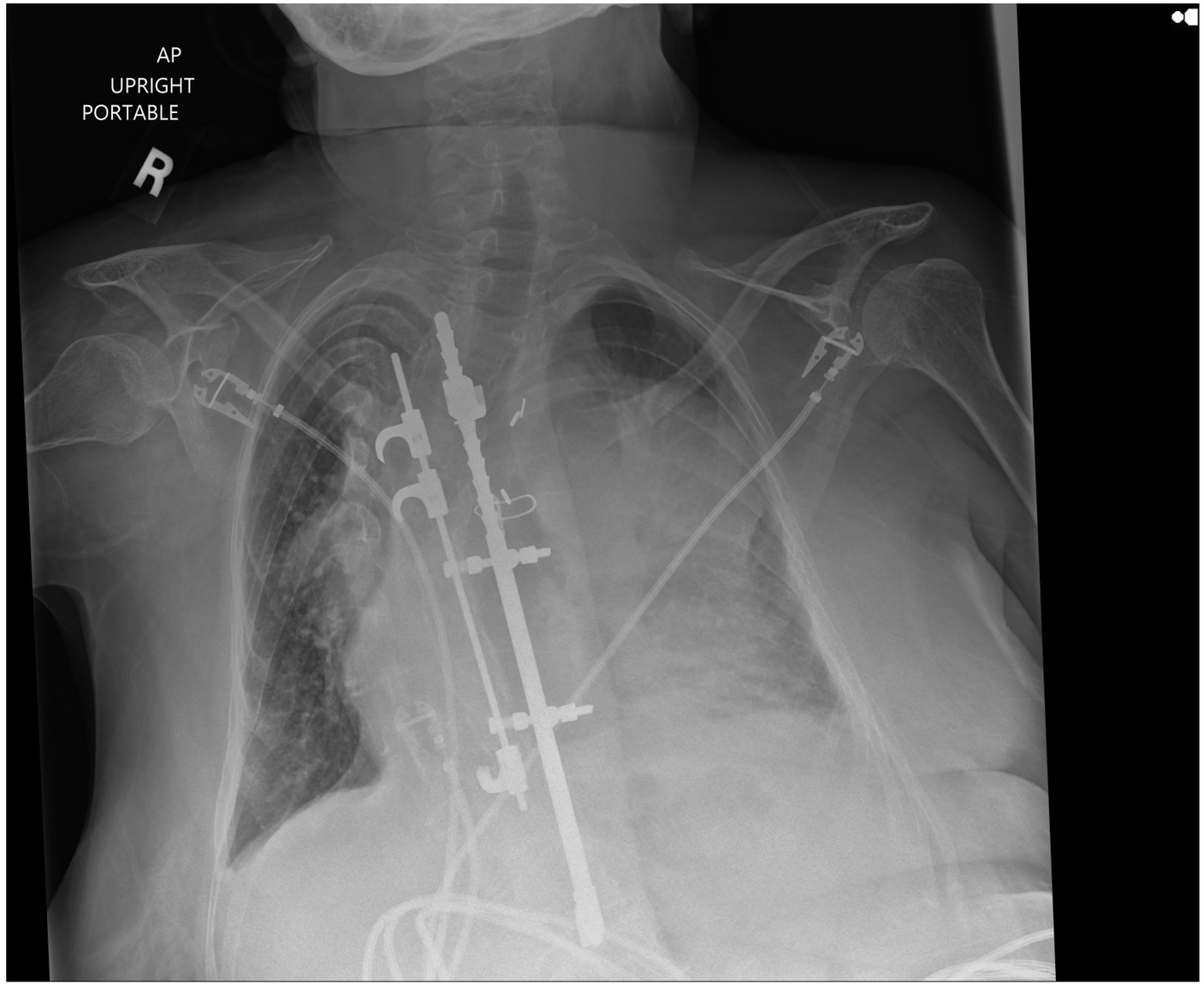


Spirometer Calibration to ATS

By: Jennifer Andrews
Same Day - 06:46 AM

Past Pulmonary Function Results for this Patient

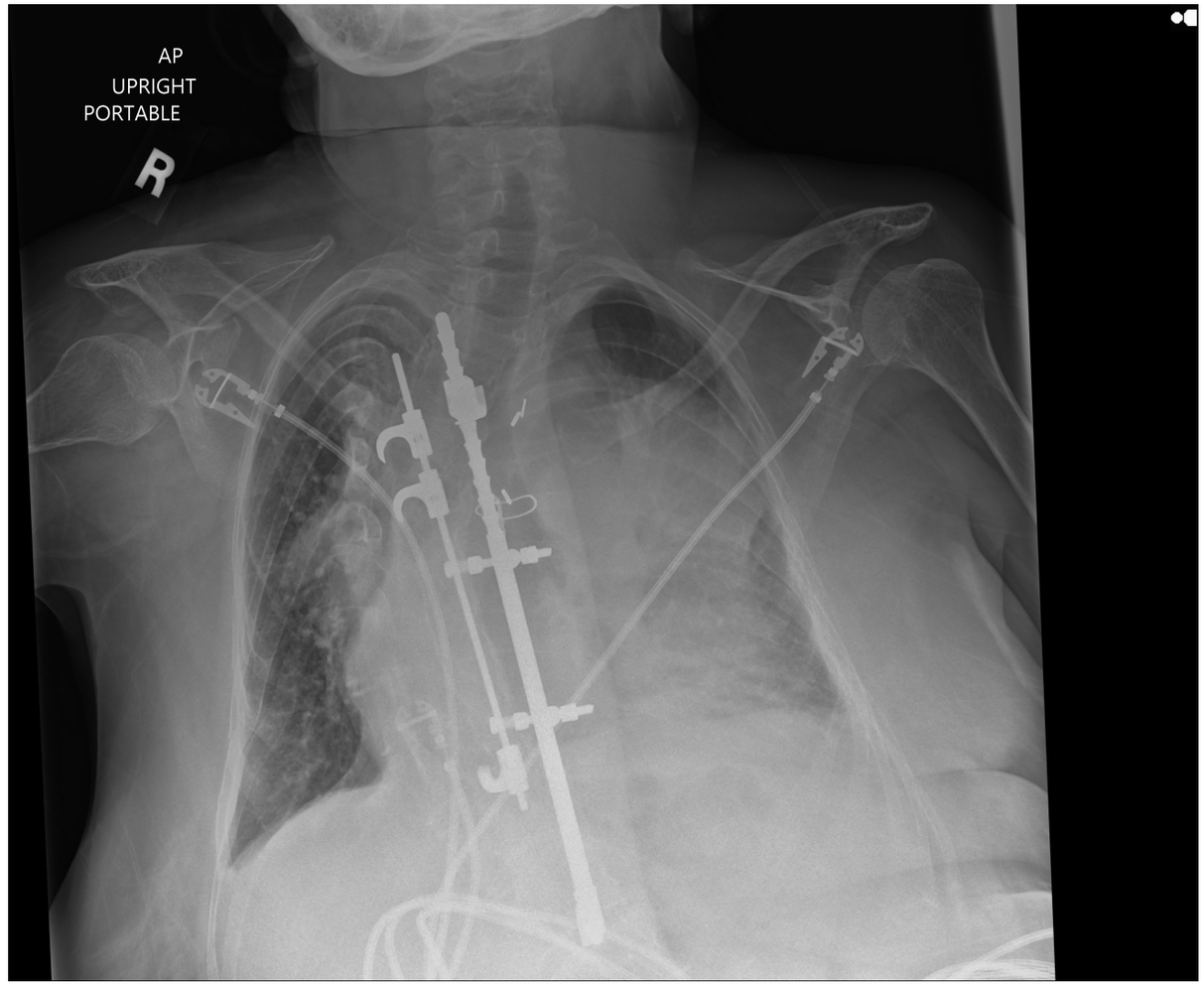
Parameter	Units	Today	Previous 1	% Diff	Previous 2	% Diff	Previous 3	% Diff	Previous 4	% Diff
		06-Dec-19	23-Aug-10		02-Aug-10		11-Aug-08		23-Oct-06	
FEV_1	L	0.46	0.49	-7	0.39	17	0.53	-14	0.58	-21
FVC	L	0.68	0.67	1	0.63	7	0.67	1	0.72	-6
FEV_1 / FVC	%	68	73	-7	62	9	79	-14	81	-17
FEF_{25-75}	L/s	0.25	0.36	-31	0.15	66	0.32	-22	0.52	-52



Admission CXR
1/31/2021

The abnormality on the CXR represents:

A. Infection
B. Lymphadenopathy
C. Primary lung neoplasm
D. Left atrium
E. Pulmonary artery



Blood cultures were obtained. She was started on levofloxacin and supported on noninvasive ventilation and supplemental O2. IPAP=15, EPAP=5 FiO2=0.50.

At this point would you like to:

A. Monitor for response to current treatment
B. Chest CT
C. Bronchoscopy with BAL
D. Transthoracic ECHO

BRIGHAM AND WOMEN'S HOSPITAL

The Lung Center

A Shocking Tale

Marjorie "Betsy" Bateman, MD

First Year Pulmonary and Critical Care Fellow

HARVARD MEDICAL SCHOOL

History of Present Illness

- 24 year old woman who reports lower extremity weakness x 3 weeks
- Additional symptoms include:
  - Fatigue, decreased appetite, weight loss
  - Intermittent fevers (last 105.5 two weeks ago)
  - Palpitations
  - Dyspnea on exertion and dry cough
  - Nausea and vomiting
- Other ROS negative

History

- **Past Medical History:** SLE diagnosed 12/2019 (presented with malar rash, weight loss, weakness, had ANA 1:160 homogeneous +dsDNA, low C3, and low C4), started on azathioprine 100 mg daily 1/2020 with dose reduction to 50 mg daily due to leukopenia in 6/2020. Prednisone was added at that time.
- **Home Meds:** vit C, azathioprine 50 daily, vit D3, prednisone 10 daily
- **Social History:** never smoker, no EtOH, no illicit substances, lives in MA, no recent travel, no known recent exposure to ticks or insects, not sexually active. Notably, she is a Jehovah's Witness.
- **Family History:** no history of autoimmune disease

Exam

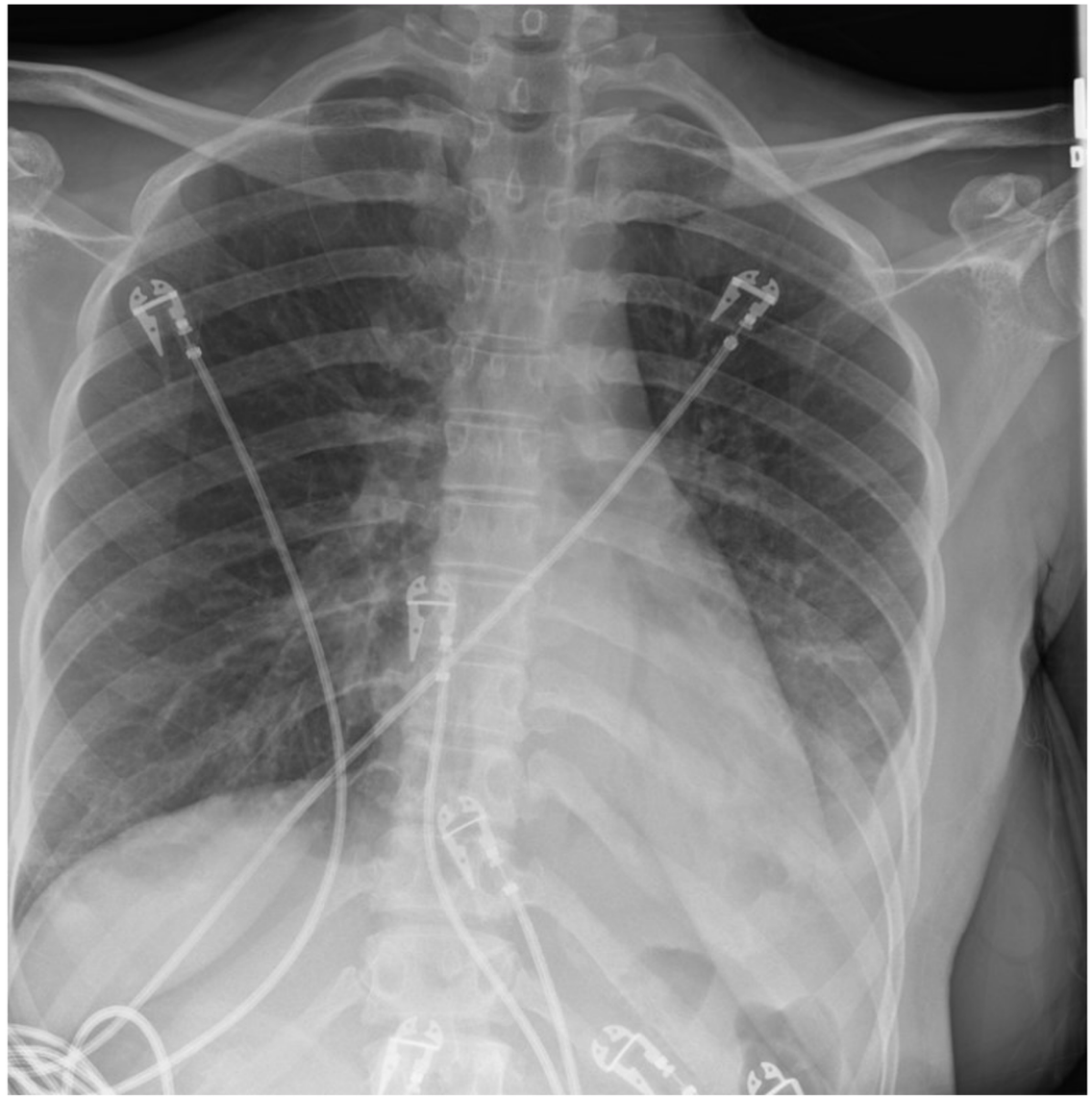
- **Temp 101.8 F, RR 30s-40s, sats 70% on RA, HR 127, BP 90/50**

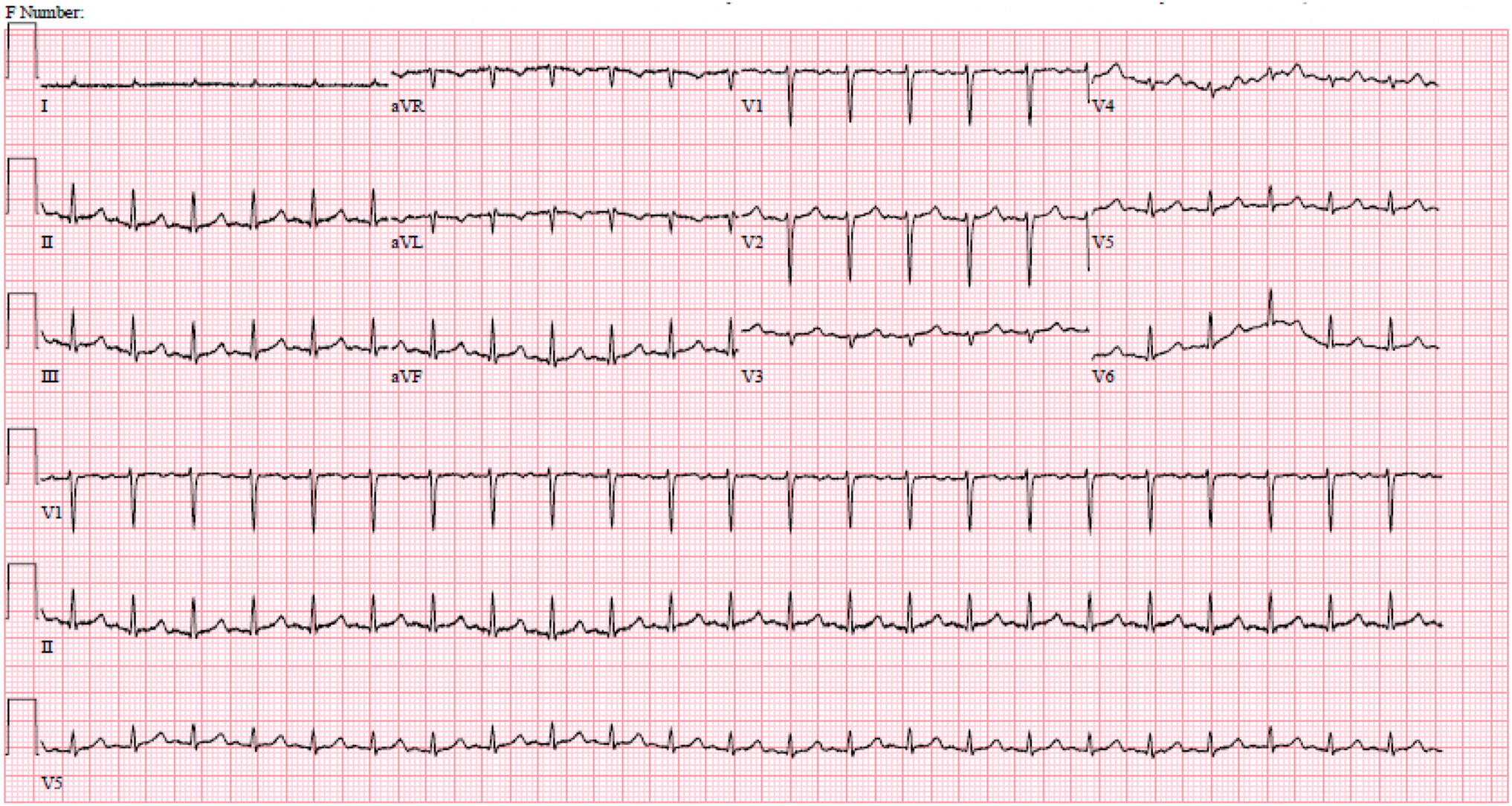
- Gen: awake, alert, fatigued
- HEENT: no lymphadenopathy, shallow ulceration R lateral tongue border
- Cardiac: tachycardic, normal S1/S2
- Pulm: lungs clear to auscultation, no increased work of breathing
- Abd: soft, nontender, nondistended
- MSK: 1+ bilateral edema to ankles, full ROM
- Neuro: alert and orientedx3, no focal deficits
- Skin: non-blanching erythematous rash on palms and soles, cool extremities

Rash

Abnormal Labs

- WBC 2.32
- Hb 5.8 with retic% 0.8, blood smear with rare schistocytes, spherocytes, microcytosis, anisocytosis, poikilocytosis, positive C3 DAT/Coombs, LDH 1264, haptoglobin 17, normal PT, mildly elevated PTT, normal fibrinogen, high D-dimer, ferritin >11k
- Creatinine 2.05
- Albumin 1.2
- dsDNA 53, C3 42, C4 7
- Troponin 282->266
- Lactic acid 2.3

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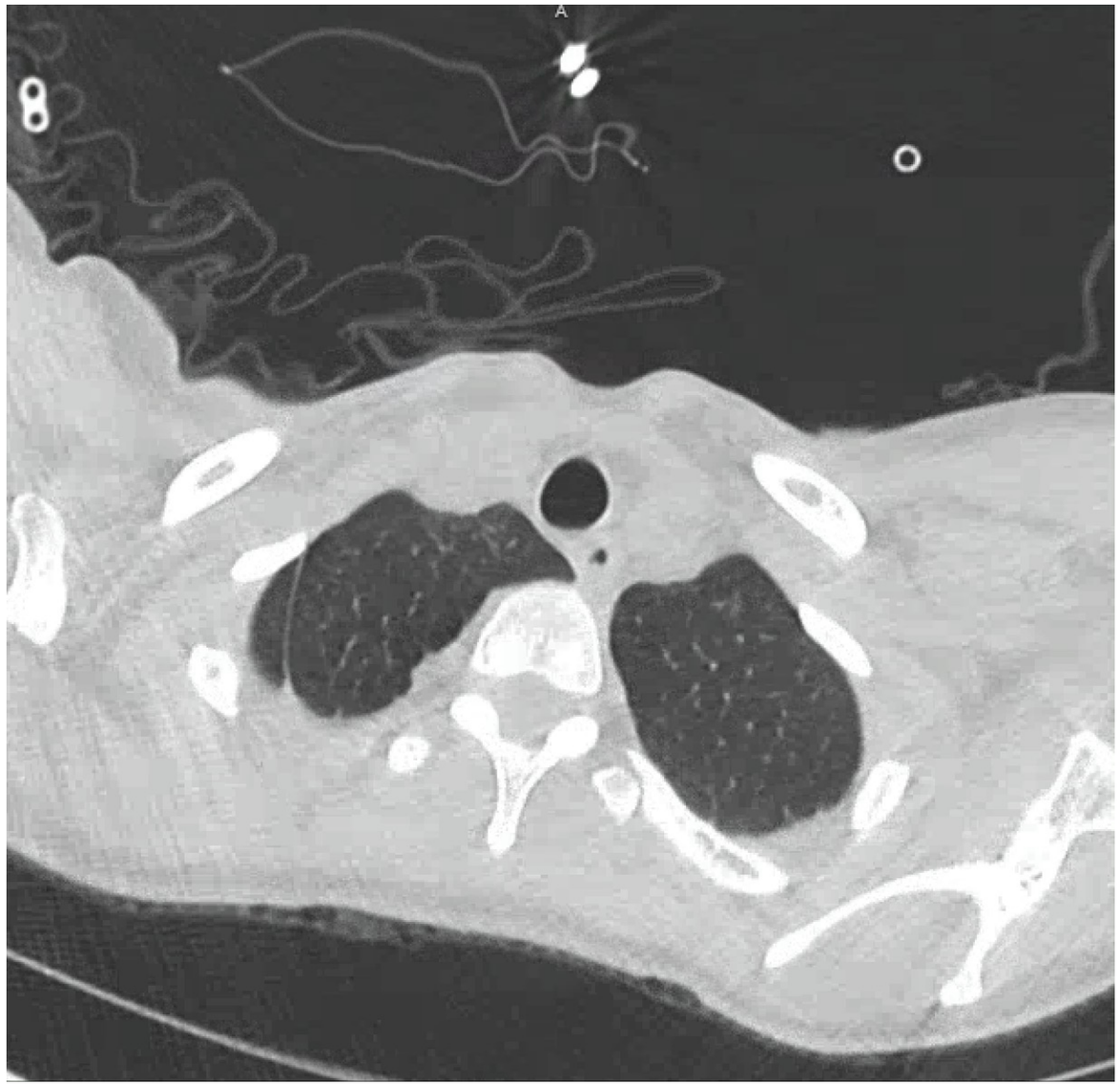
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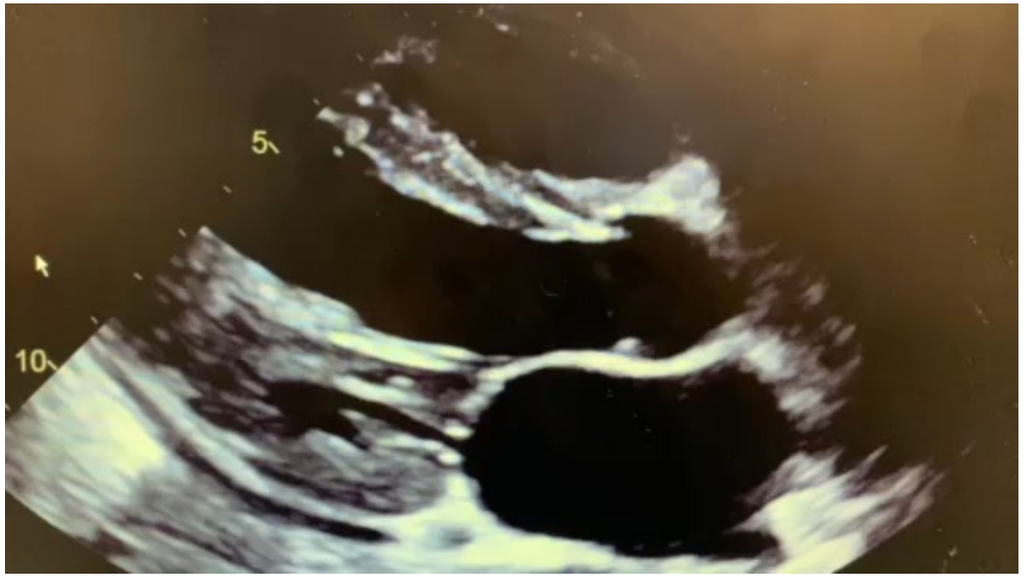
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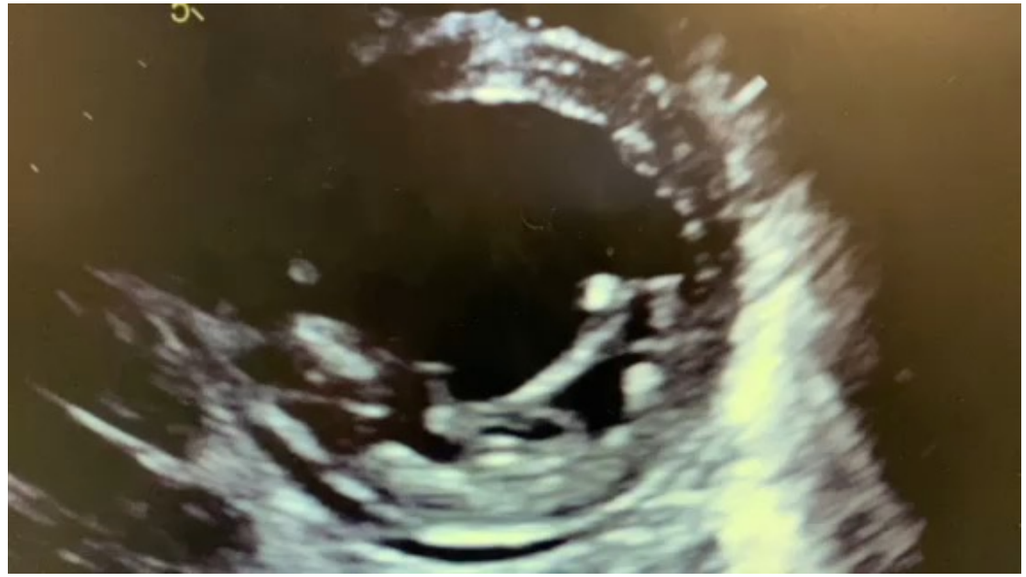

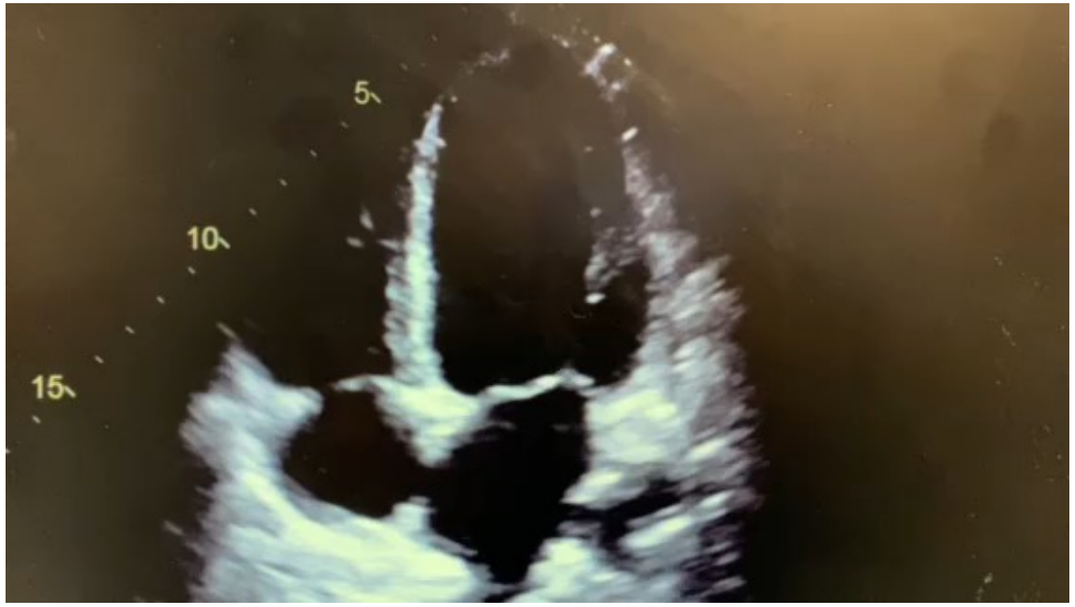
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Differential Diagnosis for Anemia

- Hemolysis - SLE, DIC causing hemolytic anemia, TTP, tick borne illness
- Hypoproliferation - bone marrow suppression from azathioprine, sepsis, or lupus v concurrent nutritional or iron deficiencies v primary bone marrow infiltration
- Bleeding

What Would You Do First to Treat this Patient's Hypoproliferative Anemia?

- A. Give hematopoietic growth factors
- B. Give blood or other blood products
- C. Continue supportive care and give fluids

What Would You Do First to Treat this Patient's Hemolytic Anemia?

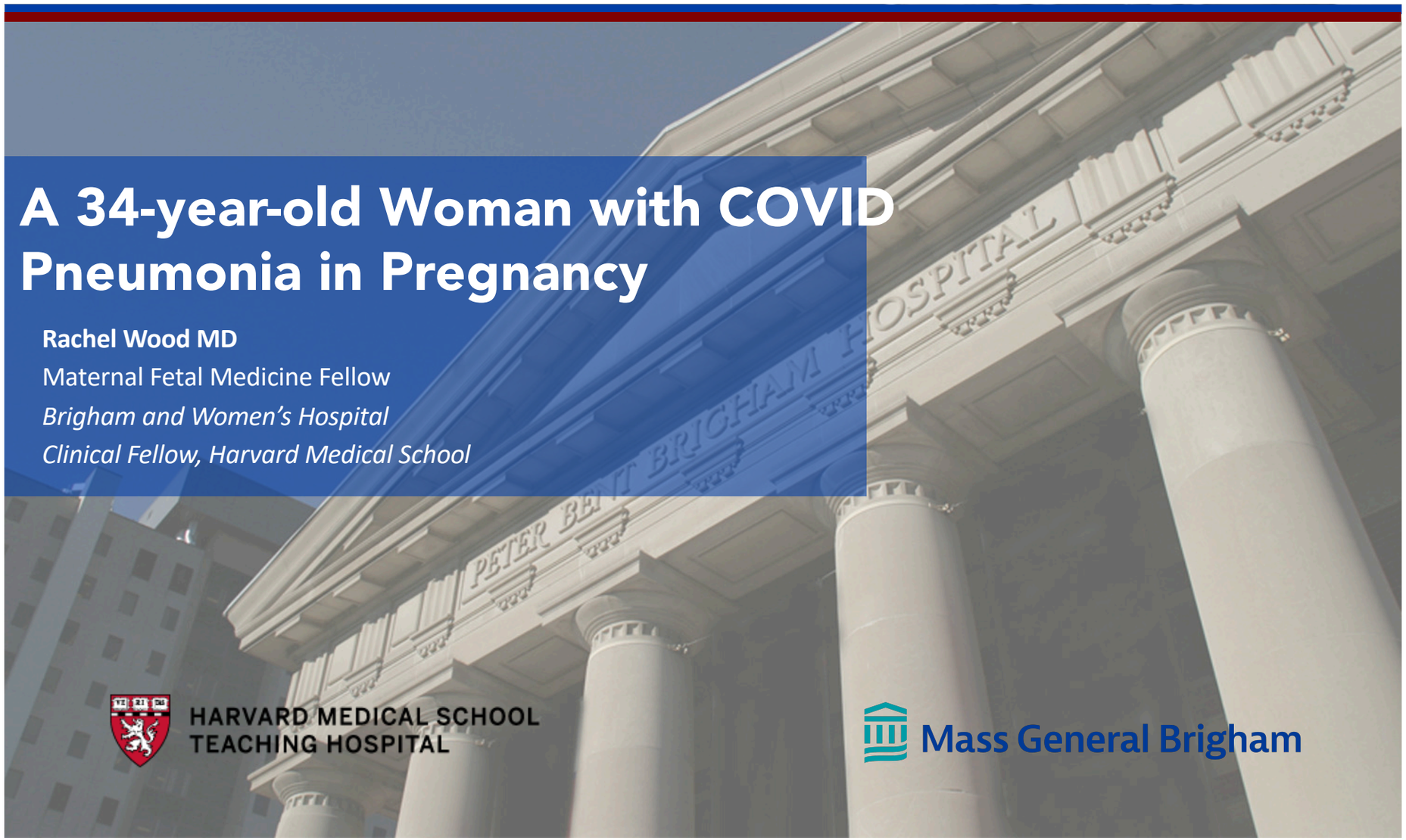
- A. Start glucocorticoids
- B. Start IVIG
- C. Start rituximab
- D. Start mycophenolate mofetil

What do you think is the main type of shock in this patient?

- A. Distributive shock
- B. Cardiogenic shock
- C. Mixed shock

BRIGHAM HEALTH

BRIGHAM AND WOMEN'S HOSPITAL



A 34-year-old Woman with COVID Pneumonia in Pregnancy

Rachel Wood MD

Maternal Fetal Medicine Fellow

Brigham and Women's Hospital

Clinical Fellow, Harvard Medical School

HARVARD MEDICAL SCHOOL TEACHING HOSPITAL

Mass General Brigham

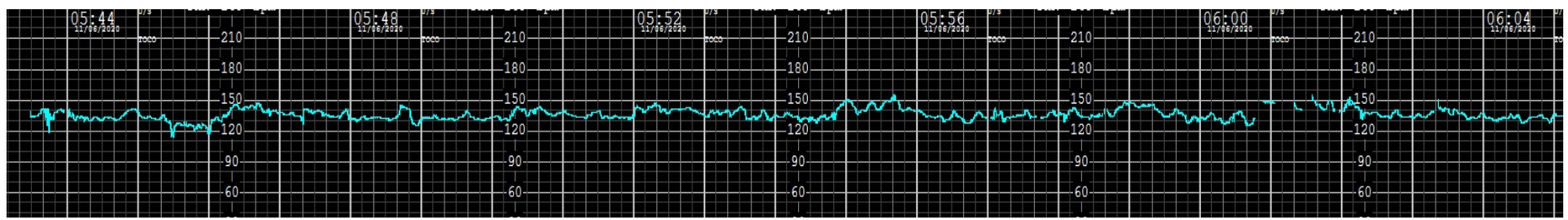
Disclosure

I have no relevant financial relationships with any entity producing, marketing, selling or distributing health care goods or services consumed by, or used on, patients that is relevant to or could be impacted by the content included in this presentation.

Case Presentation

34-year-old G7P3033 at 33w4d presents to the ED with worsening shortness of breath 9 days after first testing positive PCR test for SARS-CoV-2.

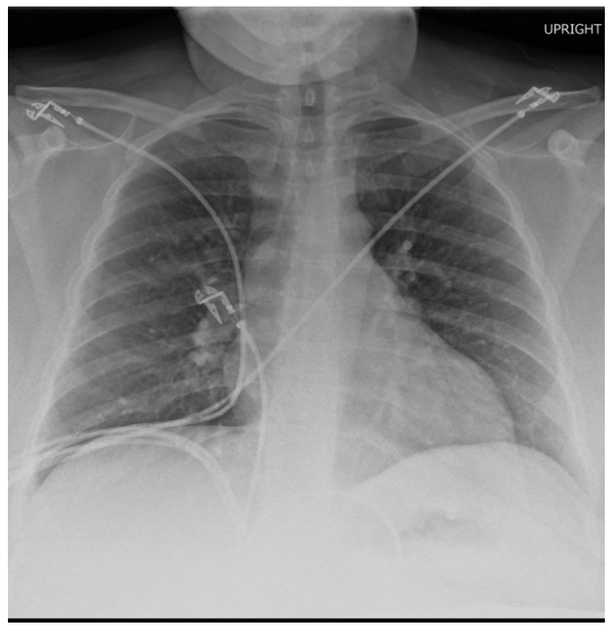
- On arrival to ED:
  - T 99.1, HR 120, BP 123/73, RR 26, O_2 94% on room air
  - AST/ALT 180/195, CRP 92.3, procalcitonin 18.43
  - Chest X-Ray: Patchy airspace opacities in bilateral lungs
  - Fetal monitoring: reactive fetal heart rate tracing



Decision Point

What intervention do you recommend next?

A. Initiate magnesium sulfate
B. Provide supplemental O_2
C. Discharge with pulse oximetry
D. Initiate remdesivir
E. Cesarean delivery



Decision Point

The patient is admitted to the hospital requiring 4L supplemental oxygen to maintain oxygen saturations > 95%. Which of the following therapies do you recommend?

A. Remdesivir
B. Barcitinib
C. Prednisone
D. Low molecular weight heparin
E. Heparin infusion

Decision Point

Hospital day 2 notable for increasing respiratory rate to 44 with oxygen requirement of 60L HFNC to achieve SPO_2 95%. Her breathing appears labored on exam prompting an ABG. Her ABG returns with pH 7.40, PCO_2 23, PaO_2 111, HCO_3 15, with AG 20. What do you do next?

A. Transition from HFNC to BiPAP
B. Prepare for intubation
C. Place epidural for cesarean delivery
D. Push 1 amp sodium bicarbonate

Decision Point

The patient is intubated with lung protective ventilation but requires paralysis and prone positioning for refractory hypoxemia. She is synchronous on the vent with BIS consistently in 40s and stable fetal heart rate tracing.

She is started on a D10 infusion with improvement in her ABG to 7.34/41/112 with HCO3 23 on AC/VC 6 cc/kg with FiO_2 60% and PEEP 17. VS include T 99.0, HR 90, BP 161 / 100, with ALT/AST 717/1003, alk phos 148, Tb 0.2. Her VS BPs 160/100 on HD3. What is your next move?

A. Discontinue remdesivir
B. Transition from propofol to midazolam
C. Prepare for delivery
D. Trial pressure control
E. Order RUQ ultrasound