Evaluation of Unexplained Dyspnea

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BWH BRIGHAM AND WOMEN'S
Department of Medicine

HARVARD
MEDICAL SCHOOL
TEACHING AFFILIATE

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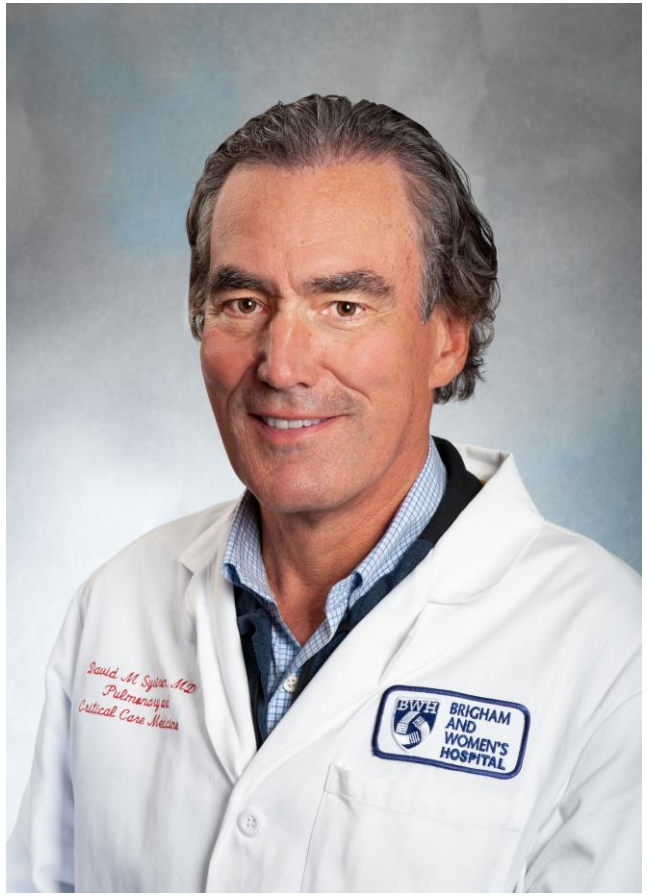


- Dartmouth Medical School
- Medicine Residency @ Emory University
- PCCM Fellowship @ Mass. General Hospital
- Assistant Professor of Medicine @ HMS
  - Clinical focus: Exercise Intolerance
  - Research focus: Exercise Intolerance

Disclosures

- I have no financial disclosures

Objectives

- Use 4 case vignettes to:
  - Highlight reasons for undifferentiated dyspnea
  - Review physiologic tools available for a definitive diagnosis

Patient MF

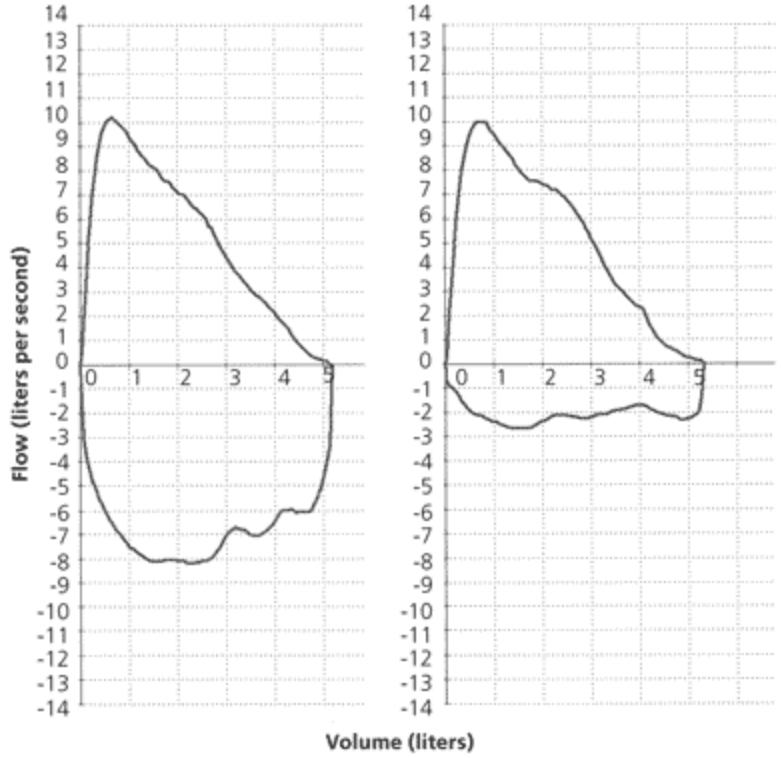
- 21 yo male Harvard Crew
- 1.5 years SOB, especially w/ intense training, competition
- Patient and mom endorsed “noisy breathing” during exacerbations
- Rapid clearing of sx, EMT’s : “normal exam”

Patient MF

- “Doc make me better, we are going to the Henley”

Pt MF

- **Exam: normal**
- **Spirometry:**



Laryngoscopy figures

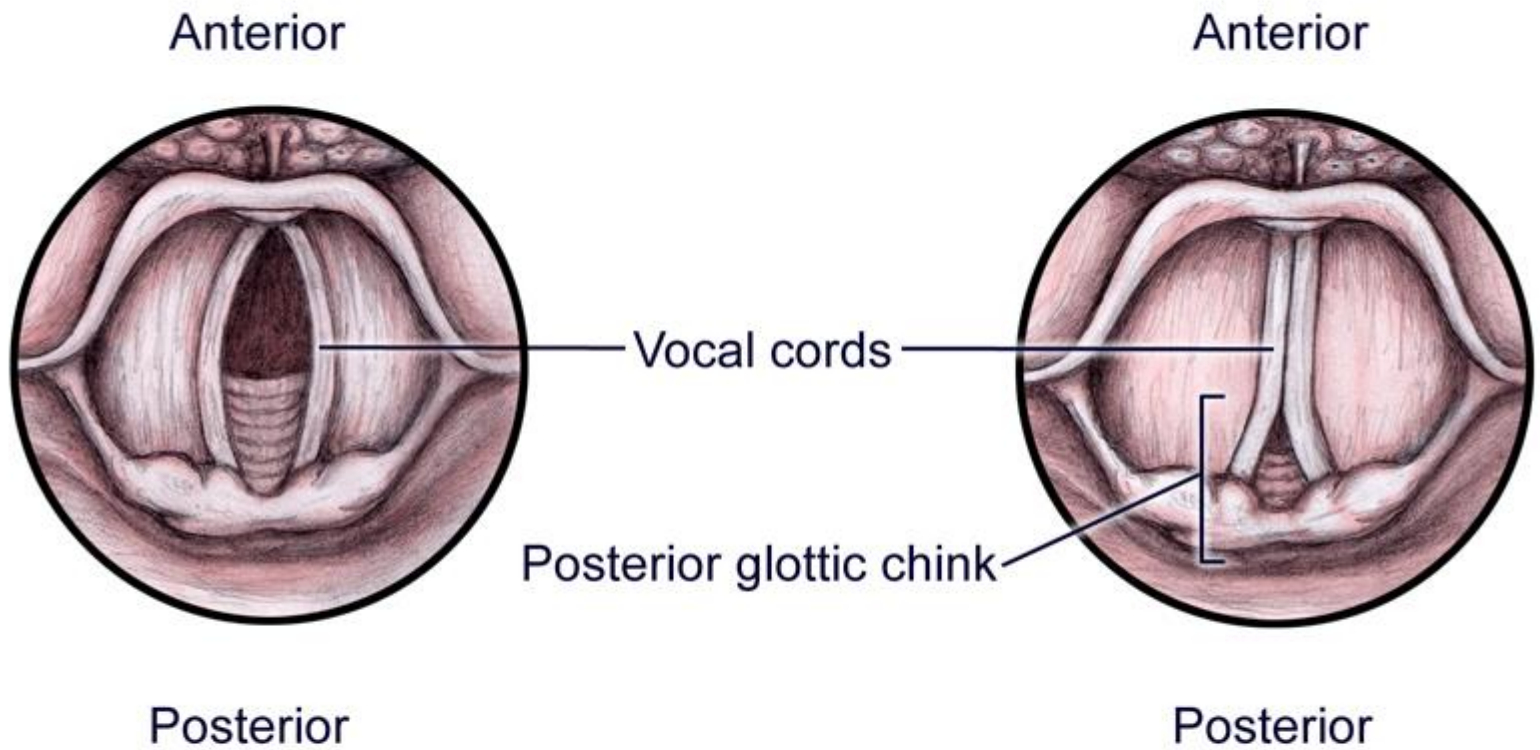


Figure C

Vocal cords during normal inspiration

Figure D

Vocal cords in a symptomatic VCD patient Note- presence of a posterior glottic chink

Vocal Cord Dysfunction

- AKA laryngeal dyskinesia
- Often young women w/ PTSD, many = conversion reaction
- Can be worsened by PNDr, GERD
- Key to hx is inspiratory stridor, hoarseness
- Often confused w/ asthma, methacholine challenge may help, ABG's should be normal
- Spirometry: flattened inspiratory F-V loop
- Confirmation w/ direct laryngoscopy: panting, full exhalation: forced inspiration, exercise… ..inappropriate closure of glottis during inspiration
- Treatment: voice training, SSRI

Pt WL

- 51 YO M, mildly obese
- Previously 35 min Elliptical, 4 d /week, TM 4.4 mph, 4 deg, 15 min.
- 3 mos. Previously, hanging an AC unit out a window, leaning over a windowsill, and had sudden R anterior sharp CP, persistent R shoulder pain and SOB since, immediate orthopnea
- No persistent cough, wheeze, F, C, sweat, B sx.

Pt WL

SPIROMETRY (BTPS)

		Predicted Mean	95% CI	Pre-BD Actual	%Pred
FVC	(Lts)	5.24	4.12	2.30	44
FEV1	(Lts)	4.14	3.30	1.70	41
FEV6	(Lts)	5.19	4.23	2.28	44
FEV1/FVC	(%)	79	71	74	94

LUNG VOLUMES (PLETHYSMOGRAPHY)

TLC	(Lts)	7.41	5.80	4.68	63

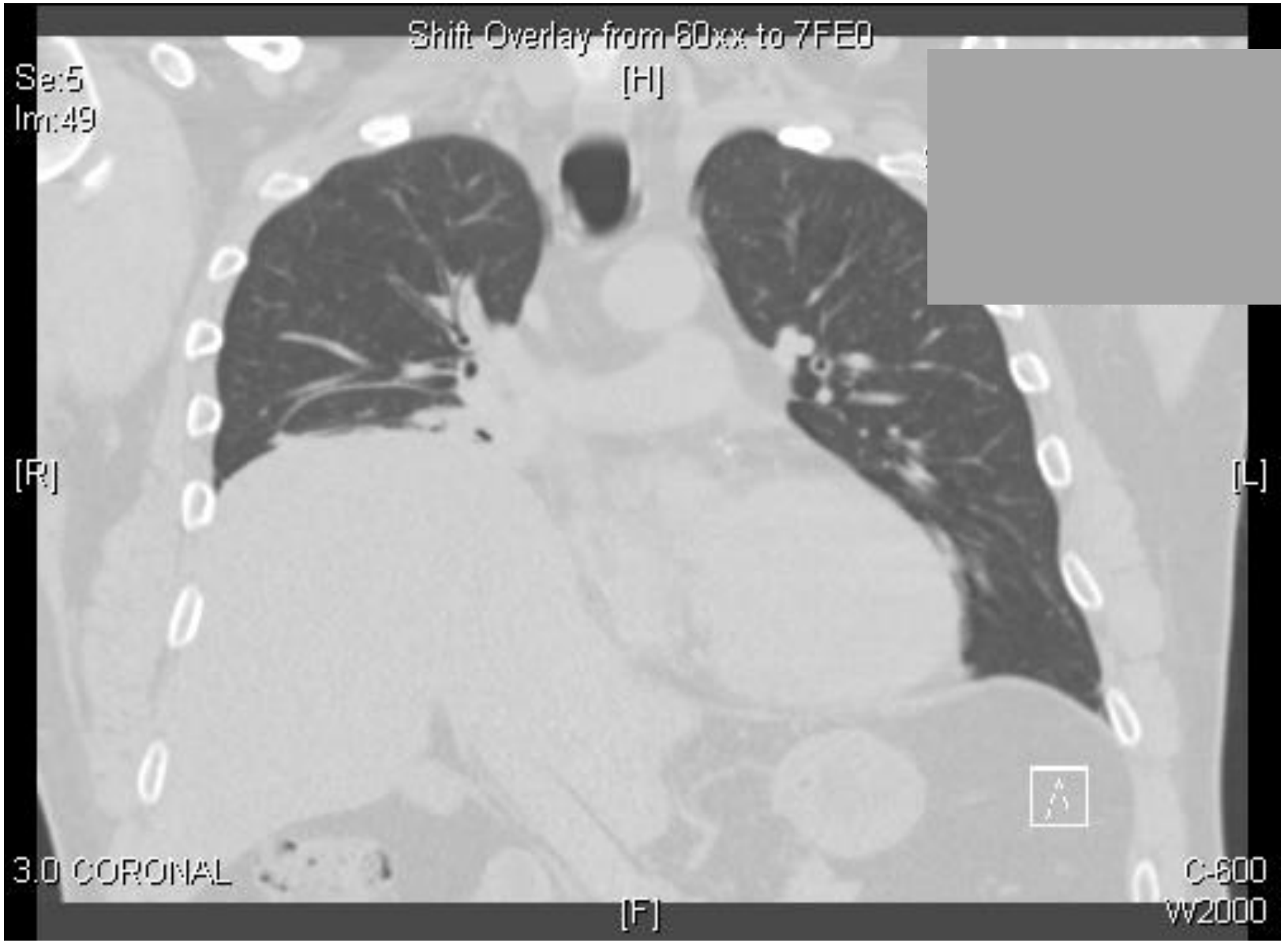
DIFFUSING CAPACITY

DLCO Unc	(mL/min/mmHg)	32.71	22.69	25.85	79
DLCO Corr (Hb)	(mL/min/mmHg)	32.71	22.69	25.85	79
VA@BTPS	(Lts)	7.41	6.26	3.93	53
DL/VA	(%)	4.43	3.50	6.58	149

RESPIRATORY MUSCLE STRENGTH

MIP			89	34	38
MEP			134	68	51

Pt WL


Shift Overlay from 60xx to 7FE0
Se:5
Im:49
[H]
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3.0 CORONAL
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C-600
W2000

Pt WL

Respiratory Muscle Weakness

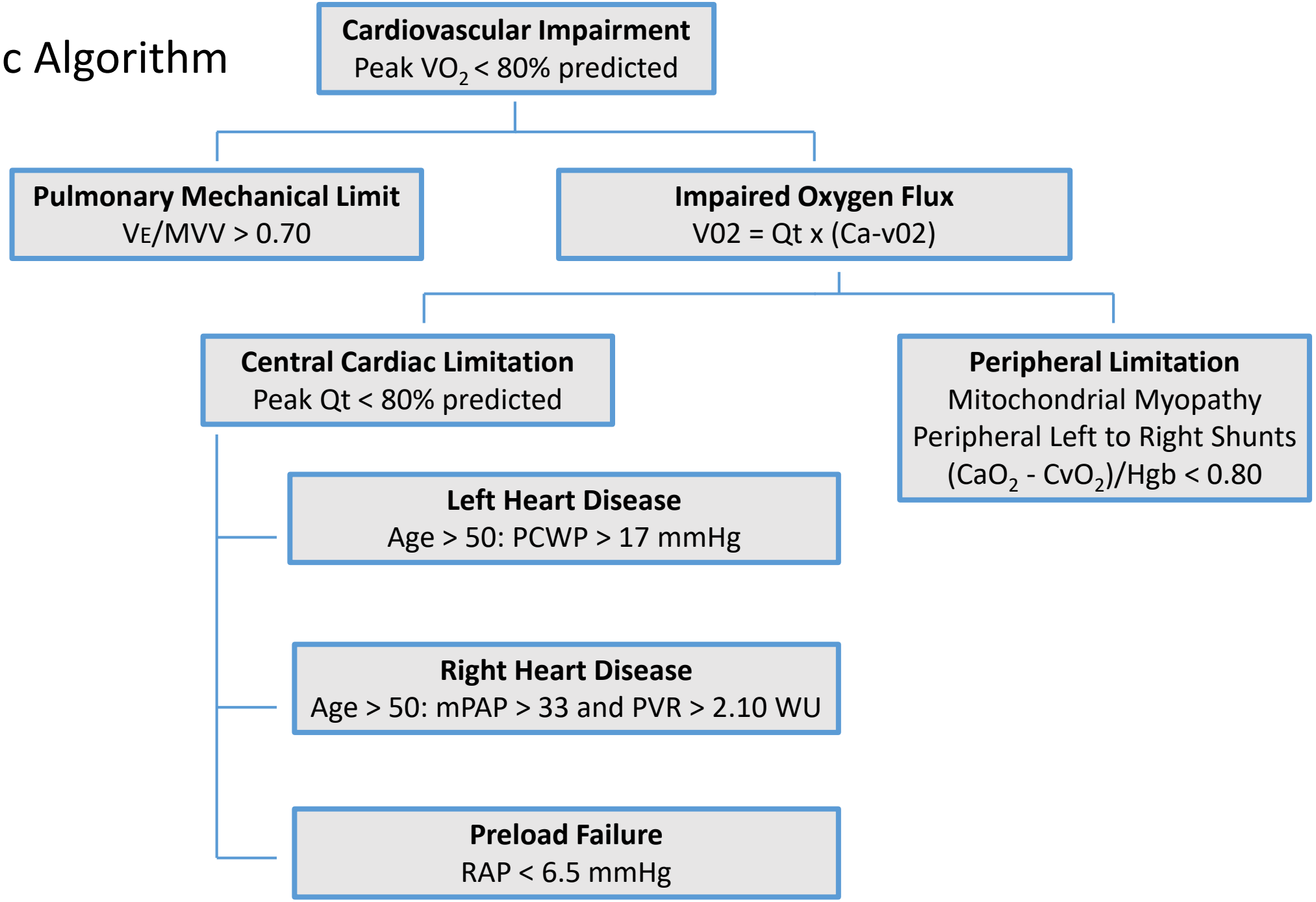
- Acute or chronic DOE, immediate orthopnea
- Usually B diaphragmatic dysfxn, but unilateral plus other can > SOB
- Diagnosis:
  - Restrictive defect may be mild
  - VC upright > supine (10% fall), MIP
  - CT chest>r/o mass, LAD
  - Phrenic nerve conduction, diaphragmatic EMG
- Treatment
  - Time, e.g., trauma, CABG
  - Weight loss
  - Elevate HOB
  - PSG: look for hypopneas>BiPAP
  - Inspiratory muscle training
  - IVIg, steroids

Pt MR

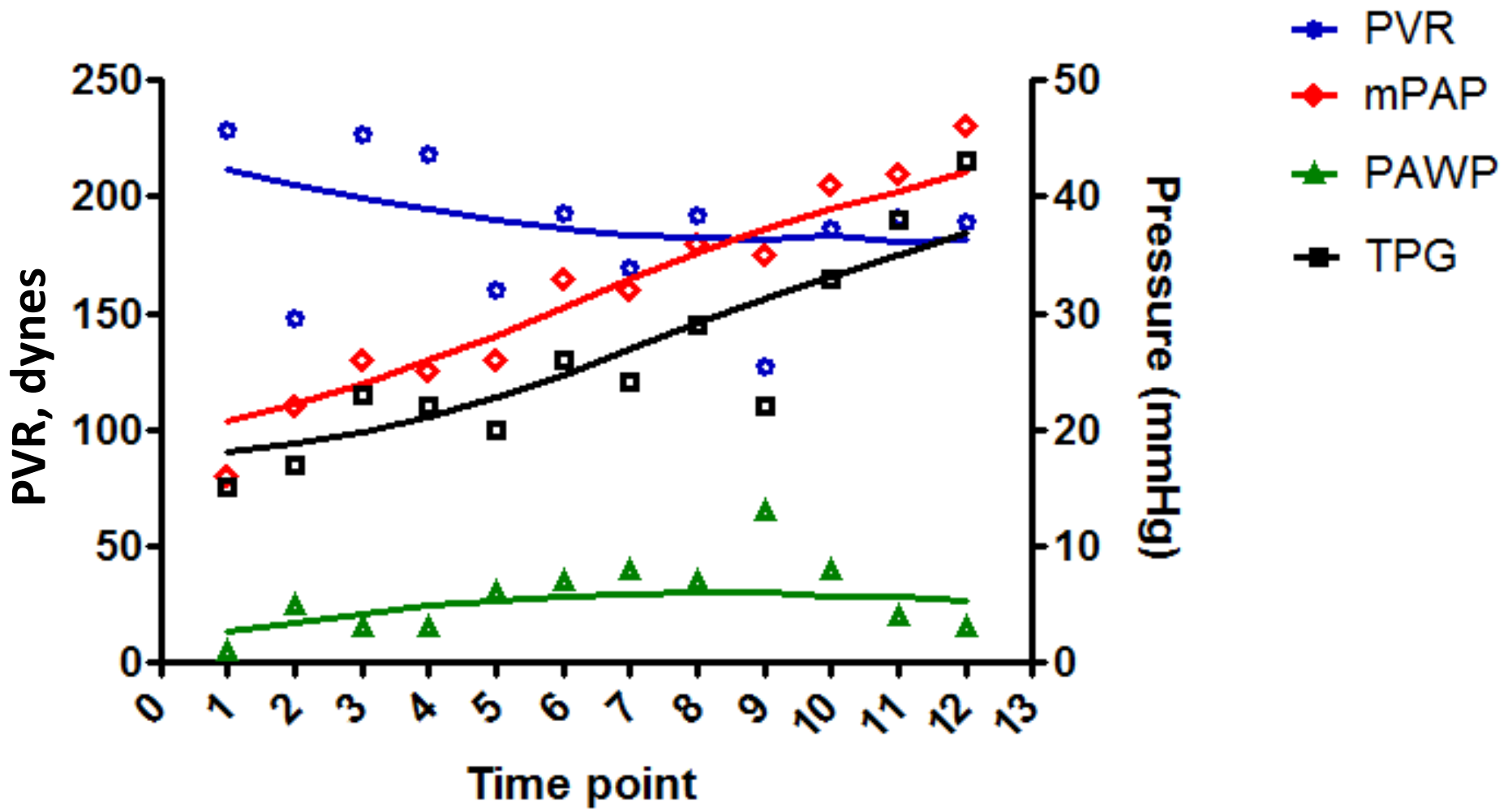
- 61 yo running Shoe Co Exec
- Two-year decline in running splits 6>8 min miles due to SOB
- No immediate orthopnea, myalgias, lightheadedness
- Exam routine labs normal
- Spirometry, TTE, CT chest, cardiac stress normal
- Invasive CPET:

Cardiopulmonary Exercise Test

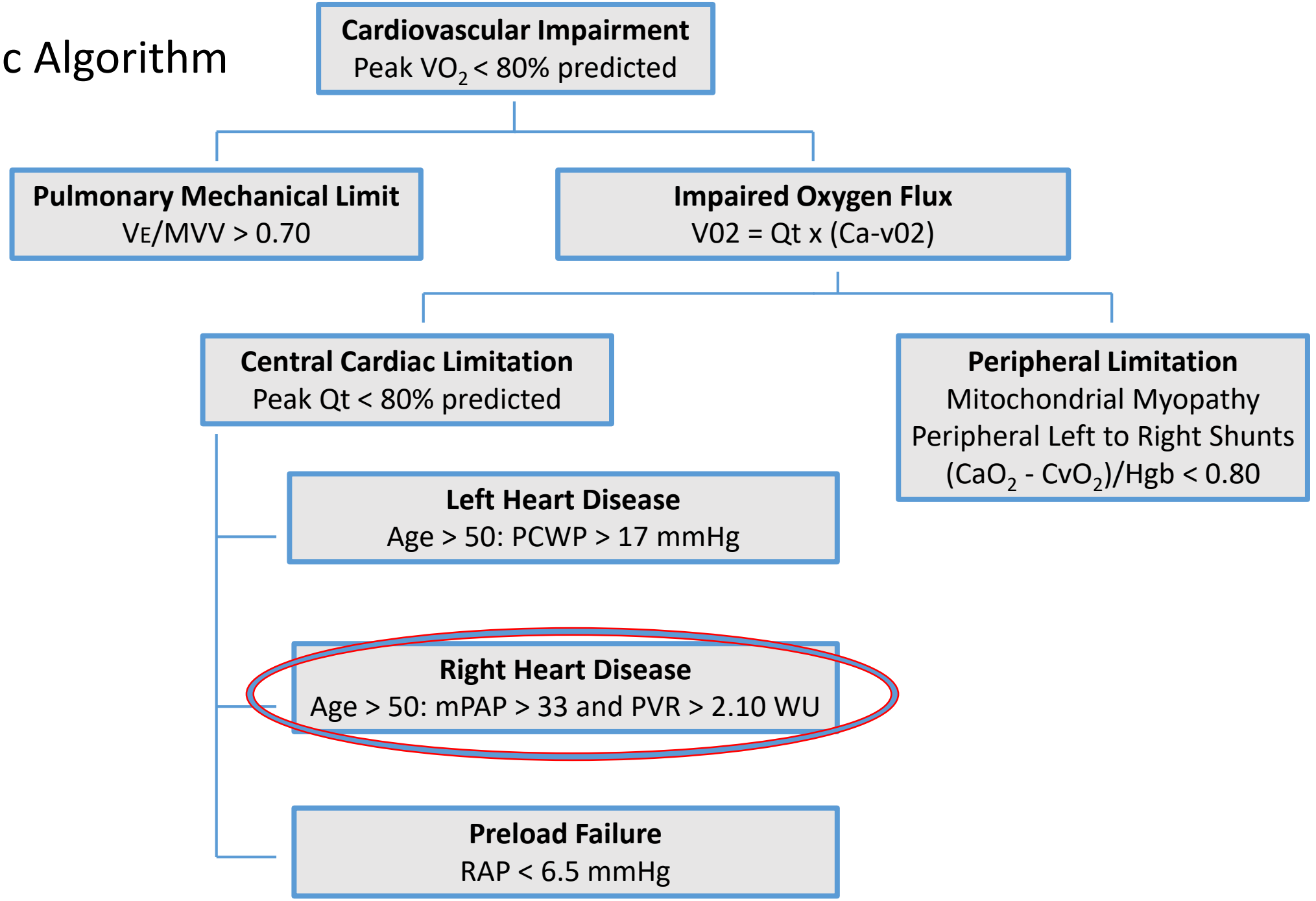
iCPET Diagnostic Algorithm



Pt MR


PVR
mPAP
PAWP
TPG
PVR, dynes
Pressure (mmHg)
Time point
250
200
150
100
50
0
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13

iCPET Diagnostic Algorithm



Circulation

JOURNAL OF THE AMERICAN HEART ASSOCIATION

Exercise-Induced Pulmonary Arterial Hypertension

James J. Tolle, Aaron B. Waxman, Teresa L. Van Horn, Paul P. Pappagianopoulos and David M. Systrom

Circulation 2008;118;2183-2189; originally published online Nov 3, 2008;
DOI: 10.1161/CIRCULATIONAHA.108.787101

Exercise PH

- Presents w/ unexplained dyspnea
- aCPET: Intermediate exercise phenotype between normal and resting PAH
- ? Early disease vs stable variant
- Missed by TTE and resting RHC
- Ambrisentan responsive, ? Others
- Need clinical trials

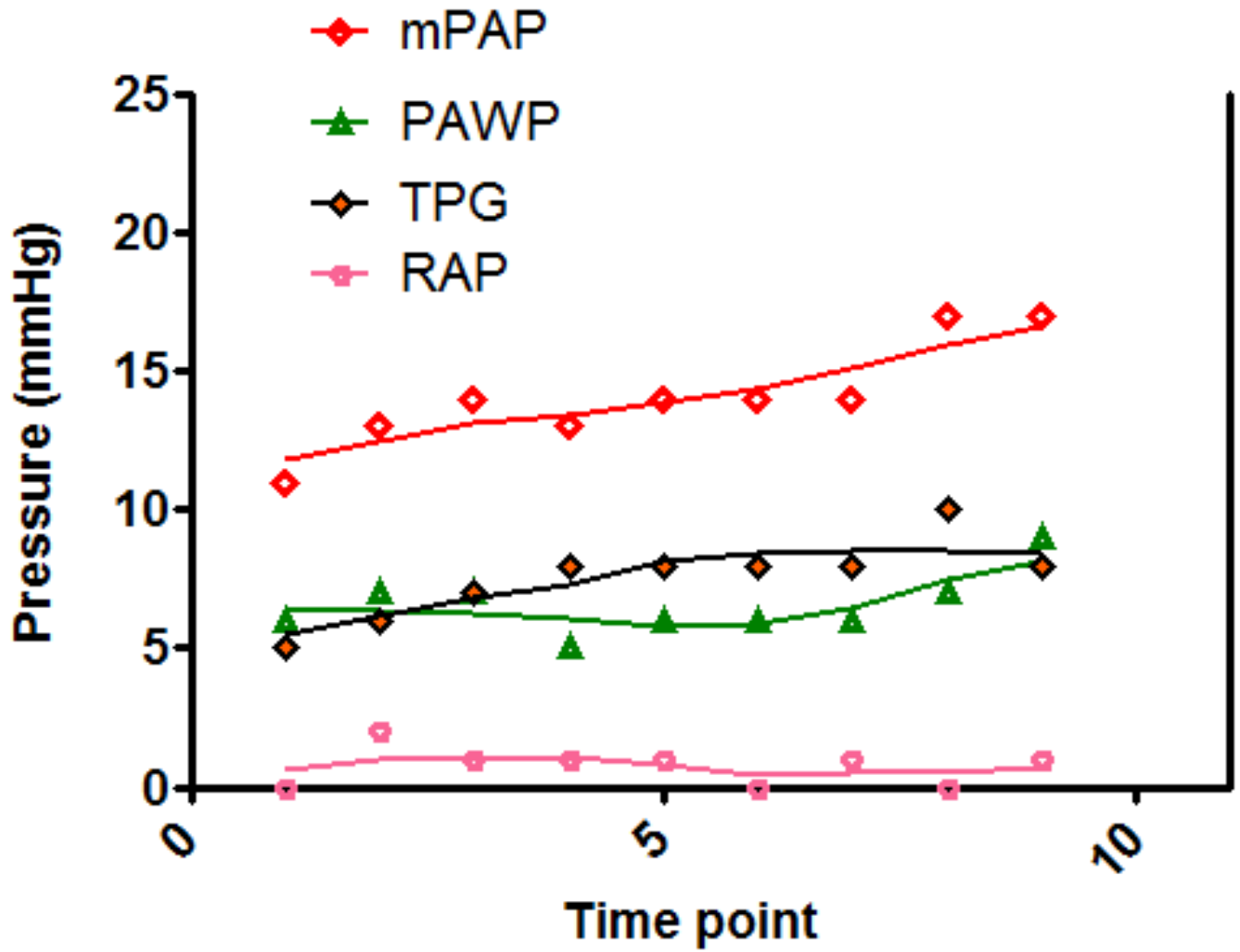
Case CG

- 42 yo F
- Well until acute COVID 3/21: cough and fever> 2 week hospitalization, ICU, no intubation
- At D/C and one yr post: fatigue, post exertional malaise, non refreshing sleep, brain fog, orthostatic intolerance, 1 FOS DOE
- Exam, routine labs, TTE, CT chest: all normal

CG: Mildly depressed V02 peak
Normal pulmonary blood flow

- ----------
- Predicted Measured % Pred
- ----------
- Peak VO2 (mL/min) 1595 1173 74%
- Cardiac Output (L/min) 11.4 10.6 93%

CG: iCPET>Preload failure



CG: Impaired Systemic 0_2 extraction

- Time Watts VO2 Qt SvO2 HR SV BP
- ----------
- REST 0 228 4.15 66.4 61 68.0 96/67
- ----------
- ----------
- PEAK 115 1173 10.57 **37.7** 131 80.7 111/69

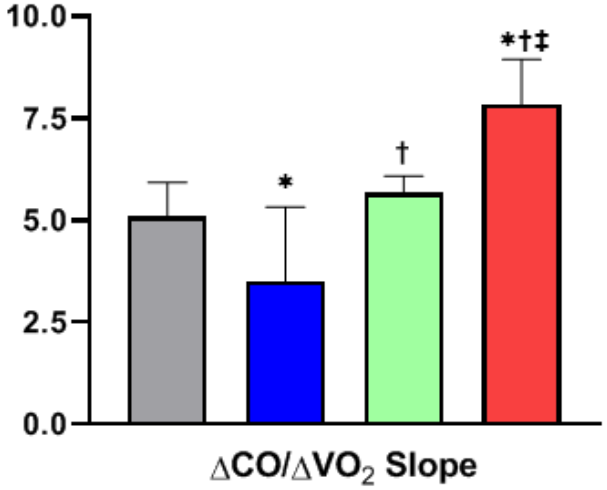
CG: Skin Bx for SFN

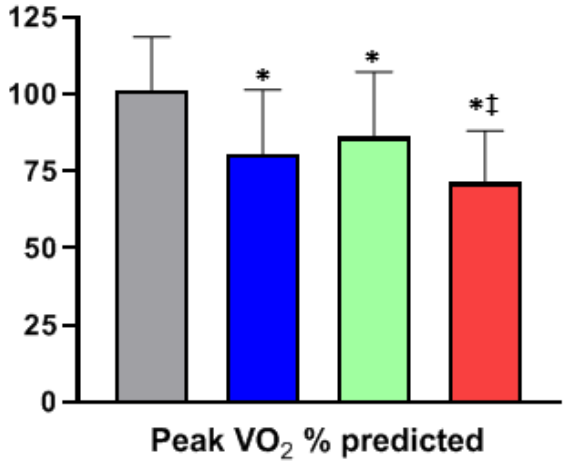
9/20/2021
Reported: 10/4/2021 13:15
Results To:
David M Systrom MD

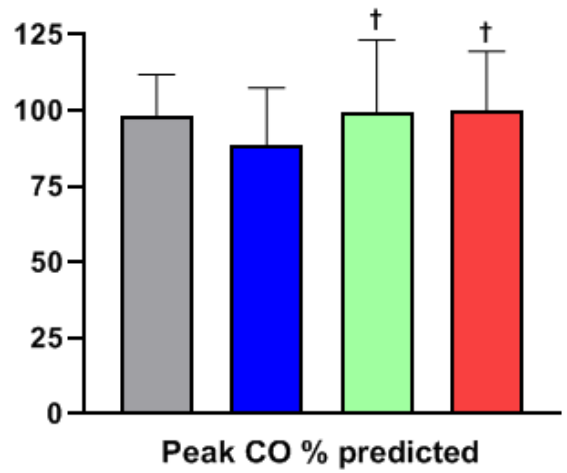
FINAL PATHOLOGIC DIAGNOSIS:
SKIN (STANDARD LOWER-LEG SITE), PUNCH BIOPSY:

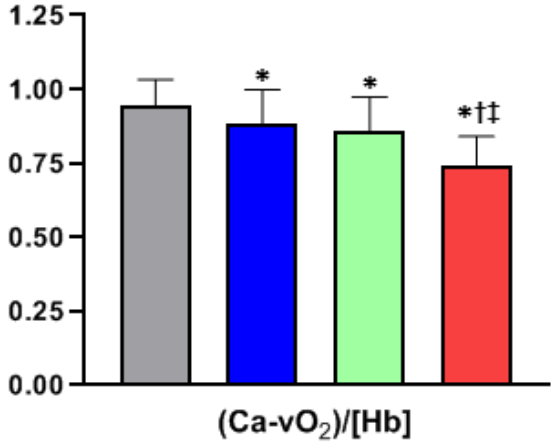
Morphometric quantitation of epidermal nerve endings yielded epidermal neurite density (END) of 117 neurites/mm2 skin surface area, at **less than the 1st centile**. ENDs d 5th centile of predicted are interpreted as pathologically confirming small-fiber axonopathy in clinically suspected patients.

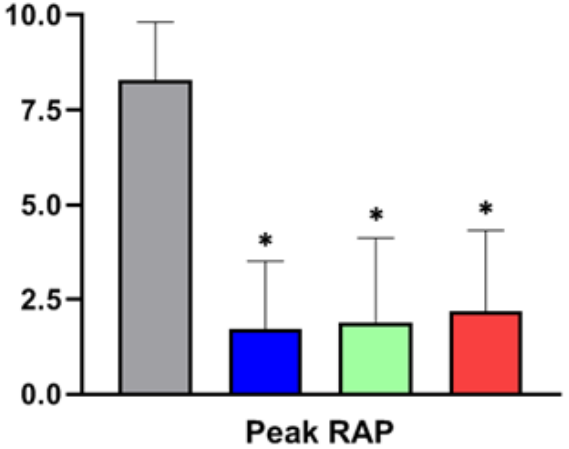
High flow v. low flow in ME/CFS

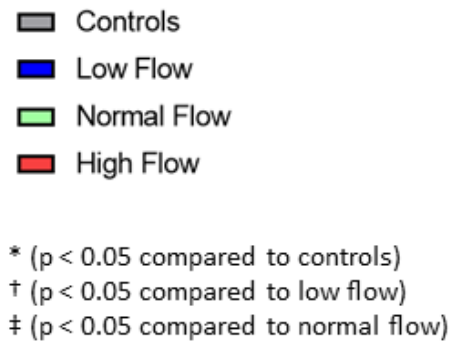






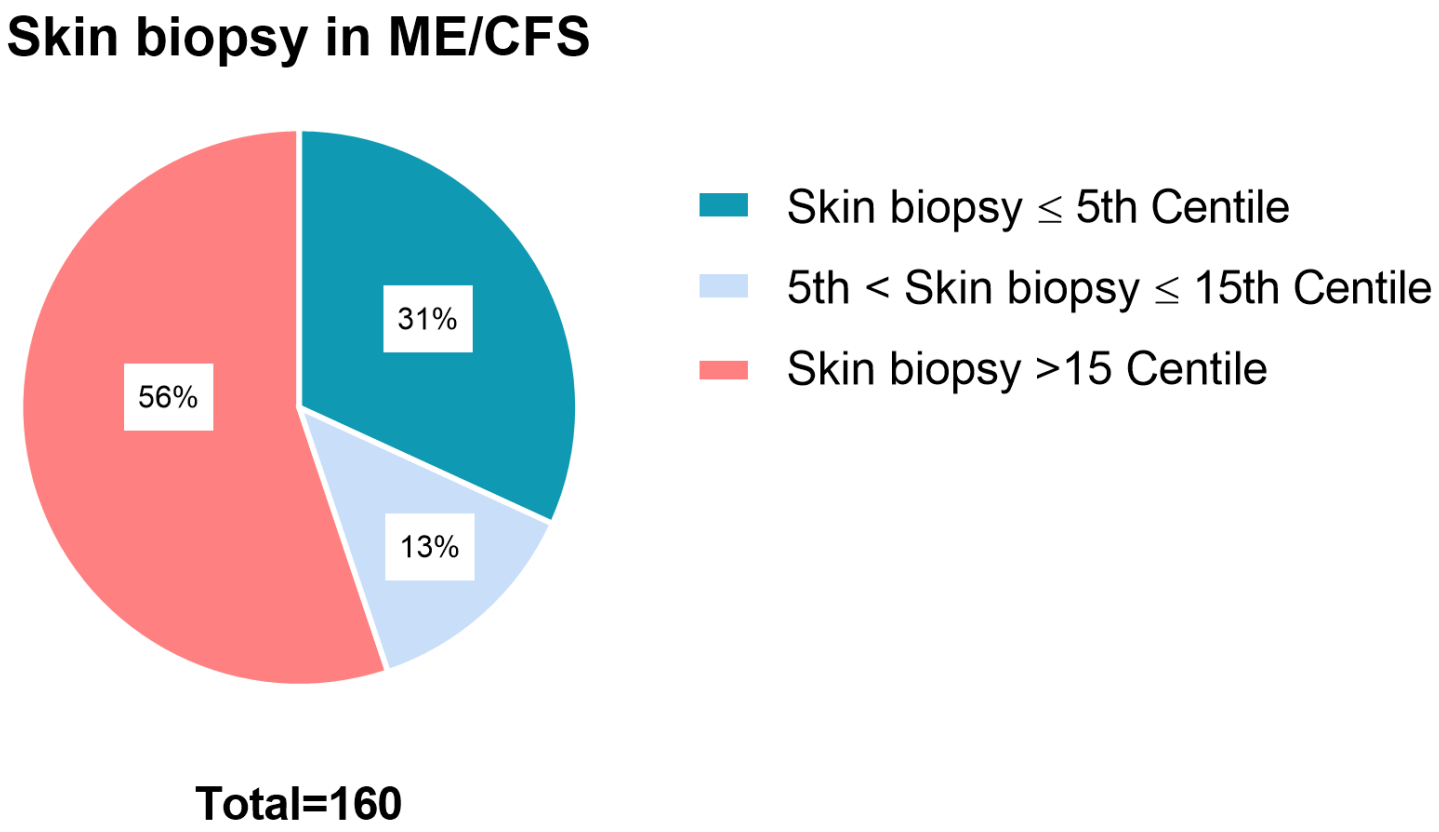






Joseph P, Arevalo C, Oliveira RKF, Faria-Urbina M, Felsenstein D, Oaklander AL, Systrom DM. Insights From Invasive Cardiopulmonary Exercise Testing of Patients With Myalgic Encephalomyelitis/Chronic Fatigue Syndrome. Chest. 2021 Feb 10:S0012-3692(21)00256-7. doi: 10.1016/j.chest.2021.01.082.

Small Fiber Neuropathy in ME/CFS



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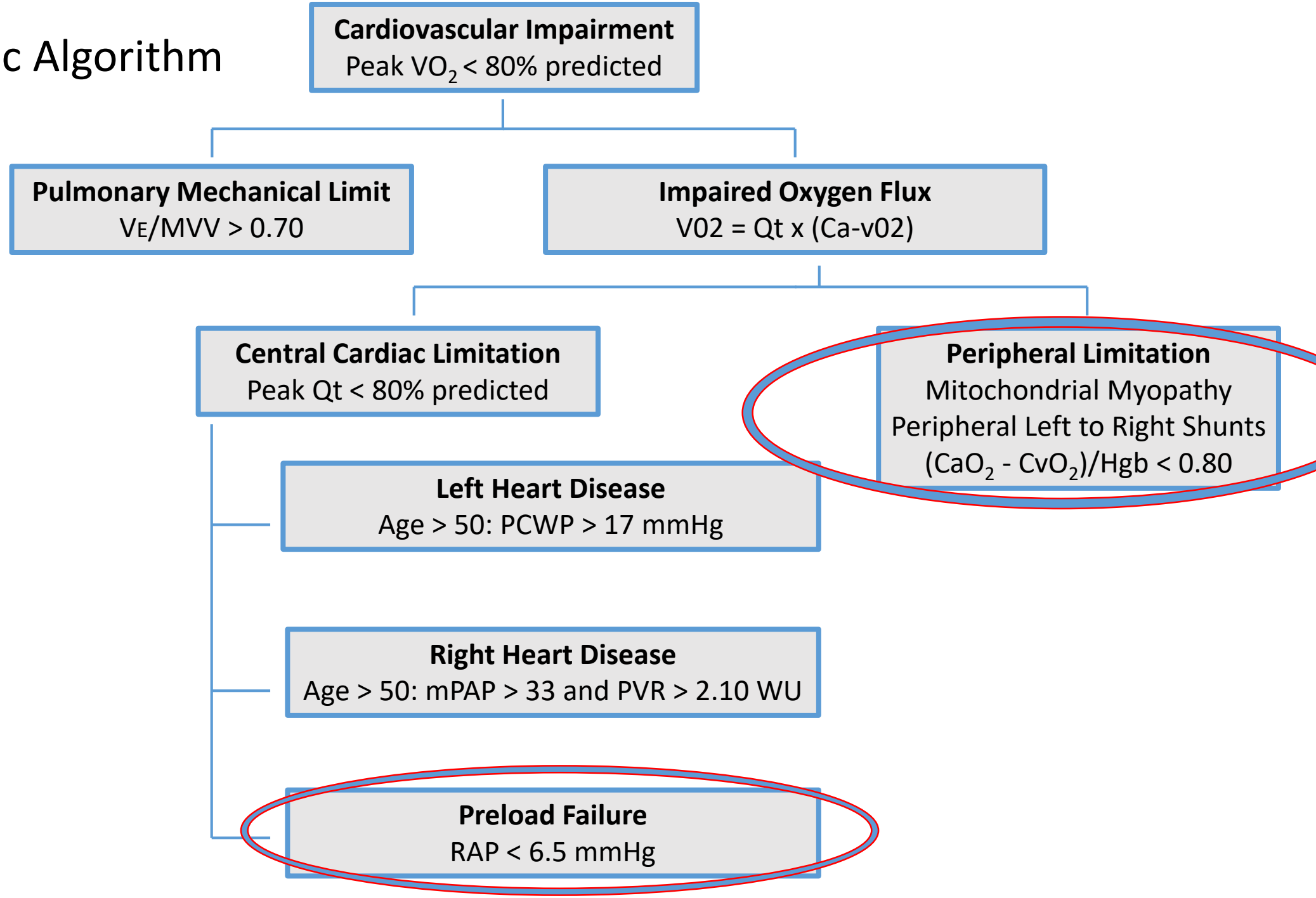
iCPET Diagnostic Algorithm



Case CG
Follow-up

- started pyridostigmine 30 mg po BID, graded exercise
- fatigue, OI and DOE “85% better”

ME/CFS & Long COVID

- Female predominance, fatigue, PEM, non-refreshing sleep, brain fog, lightheadedness and DOE
- Routine w/u often neg.
- AFT including skin bx for SFN useful
- iCPET > neurovascular dysregulation & hyperventilation
- Rx salt and H_20 load, compression stockings, POTS drugs, IVIg, graded exercise

Take-Home Messages

a. Unexplained dyspnea is defined as un or under-explained sx after a thorough hx, exam, routine labs, full PFT's, TTE and chest radiography when appropriate
b. Additional testing might include an ENT eval, MTC, MIP's
c. iCPET can rule in or out exercise-induced PH, CHF, preload failure and mitochondrial dysfunction

Board Questions

18 yo F presents w/ two years of DOE and subjective wheezing. Exam in office is normal. PEFR in the office and field is repeatedly normal. SABA and ICS/LABA have not helped. The next step should be:

a. Escalation of asthma controllers, e.g., tiotropium
b. CT chest
c. TTE
d. Cardiopulmonary exercise testing
e. Methacholine challenge

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b. CT chest
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e. Methacholine challenge

Board Questions

23 yo F presents w/ 18 mos of DOE following acute COVID. Her DDx includes:

a. eiPAH
b. Preload failure
c. Mt myopathy
d. All of the above
e. b&c

Board Questions

- 23 yo F presents w/ 18 mos of DOE and episodic lightheadedness following acute COVID. Her DDx includes:

a. eiPAH
b. Preload failure
c. Mt myopathy
d. All of the above
e. b&c

References

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