

Approach to Peripheral Edema in Long-Term Care

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Vice-Chair, Instrument and Systems Development Committee, interRAI Global;
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Objectives

- How to differentiate common causes of peripheral edema in LTC
- Practical bedside assessment approaches
- When further investigation is warranted—and when it isn't
- Management strategies that balance clinical benefit with resident comfort and care goals
- Common pitfalls and clinical pearls for LTC teams

(Yes, there will be some physiology)

A (somewhat contrived) case

- 85-year-old woman admitted to your LTC home from hospital
 - Had been admitted with a fall, delirium and functional decline
 - Deconditioned and rehabilitation unable to restore sufficient independence
- Comorbidities:
 - Mild-moderate mixed dementia: Prior lacunar strokes
 - Depression
 - Restless legs
 - BMI 35, Obstructive Sleep Apnea
 - Atrial fibrillation
 - Hypertension
 - Diabetes mellitus Type 2:
 - peripheral neuropathy, eGFR 50 mls/min, healing left medial lower leg wound
 - 45 pack-year smoker
 - Bilateral knee osteoarthritis
 - Chronic venous stasis dermatitis

Medications

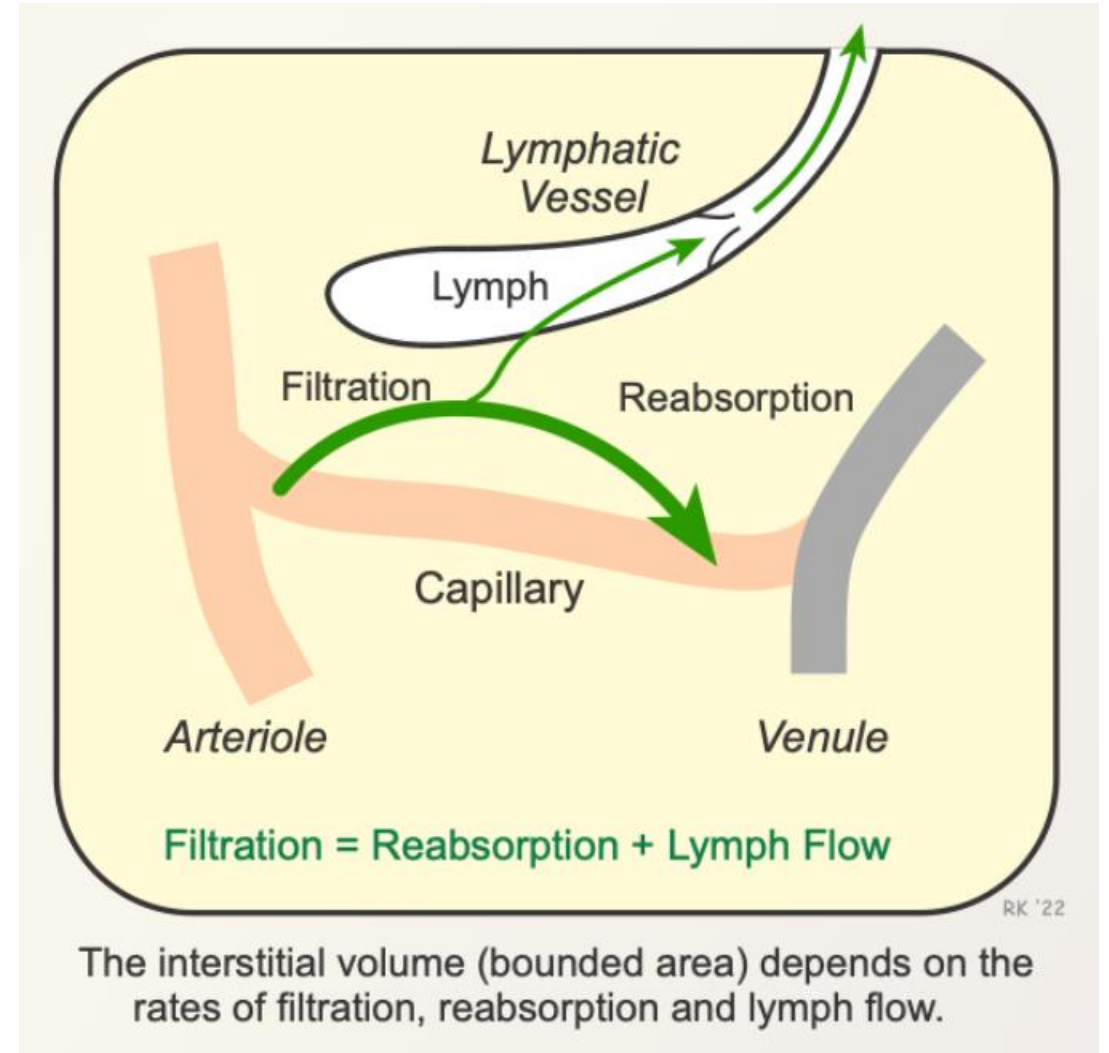
- Apixaban 5 mg po bid
- Bisoprolol 5 mg po od
- Amlodipine 10 mg po od
- Pregabalin 75 mg po tid
- Pramipexole 0.25 mg po od
- Mirtazapine 30 mg po od
- Lansoprazole 30 mg po od
- Denosumab 60 mg q6months
- Vitamin D 2000 IU po od
- B12 500 micrograms/day
- Furosemide 40 mg po prn leg swelling

Admission MDS 2.0 outputs

- | | |
|-------------|--------------------------------------|
| • CPS 2/6 | ~MMSE 19 |
| • ADLH 4/6 | Extensive assistance with locomotion |
| • CHESS 2/5 | low health instability |
| • DRS 2/14 | mild symptoms |
| • FRS 6/8 | 7% annual hip # risk |
| • Pain 0/4 | No pain |
| • PURS 3/8 | prior wound, dyspnea |

Physiology of edema

- Clinical manifestation of increased interstitial fluid
- Normal water distribution
 - 2/3 intracellular
 - 1/3 extracellular
 - 75% of that interstitial
- *Net fluid extravasation into interstitium from arteriole to venules, removed by lymphatics*



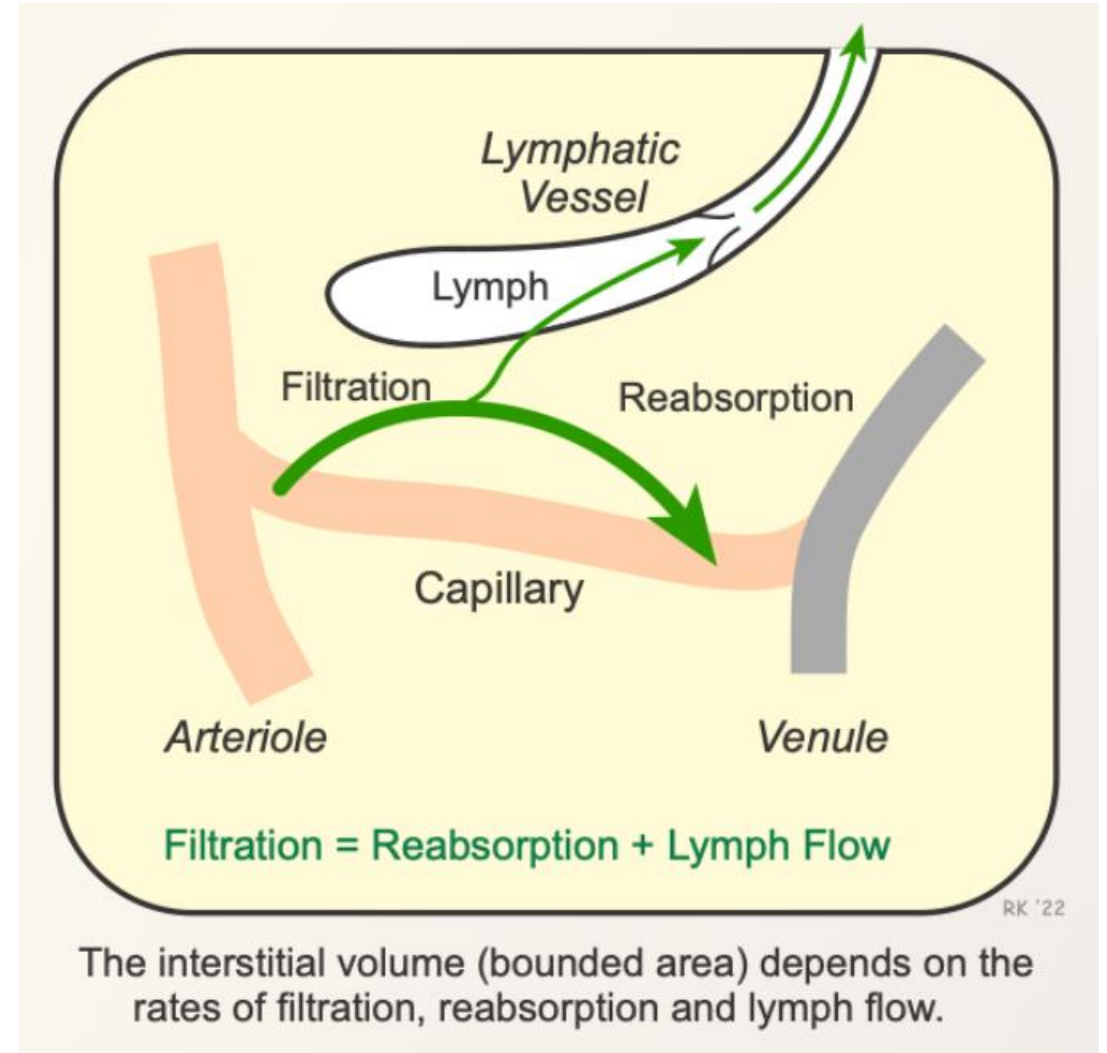
The players

Largeau et al Br J Clin Pharmacol 2021; Braunwald and Loscalzo, Chapter 36, Harrison's Textbook of Internal Medicine, 17th Ed.

- Hydrostatic pressure: within vessels
 - pushes fluid out of vessels into tissue
 - Interstitial pressure: within tissue
 - pushes fluid out of tissue into vessels
 - Oncotic pressure: driven by
 - intravascular proteins: out of vessels into tissue
 - interstitial proteins: out of tissue into vessels
 - Capillary permeability and surface area
- ← Drops from arteriolar side to venous side

Physiology of edema

- Normal balance
 - Fluid movement from arteriolar side into tissue because hydrostatic pressure dominates
 - Fluid movement on venous side into venules because hydrostatic pressure has fallen and interstitial pressure dominates
 - Lymphatics take up the rest

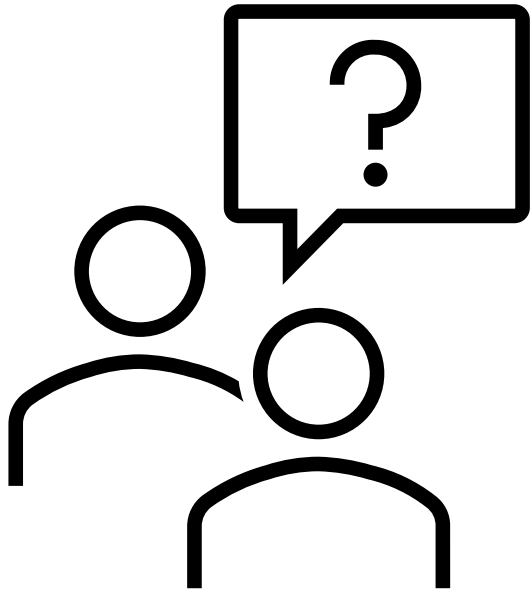


Edema: when the players are disrupted

- Increased hydrostatic pressure
 - Increased intravascular fluid: heart failure, renal failure
 - Increased venous or lymphatic pressure
 - Pulmonary hypertension: COPD, HF, ILD, sleep apnea
 - Tricuspid regurgitation
 - Lymphedema
 - Increased abdominal pressure (ascites)
 - Venous thromboembolism, Baker's cyst rupture (usually unilateral)
 - Vein stripping, saphenous vein removal
- Decreased interstitial pressure
 - Immobility
 - “calf pump”
- Disrupted oncotic pressure from hypoalbuminemia:
 - Malnutrition
 - Liver disease
 - Nephrotic syndrome
 - Malnutrition
 - Protein-losing enteropathy
- Disrupted capillary permeability: inflammation, infection
- Other: idiopathic cyclic, myxedema

Drugs!

- Arteriolar vasodilation:
 - **calcium channel blockers** (dihydropyridines), hydralazine
 - **gabapentinoids**
 - Anti-parkinsonian: D1 and D3 receptors
 - Some antidepressants (5-HT₂ receptor inhibition): escitalopram, mirtazapine, venlafaxine
- Fluid retention
 - **NSAIDs**
 - **Steroids**
 - Aromatase inhibitors
- Others: anti-cancer, some antipsychotics (higher doses), Aciclovir, PPIs, narcotics



What to do?
What to do?

Essential elements of the history and physical

- Site:
 - Unilateral/localized: DVT, Baker's cyst, infection
 - Bilateral lower extremity (sacral!)
 - Generalized: cardiac, renal, liver, severe malnutrition
- Timing of onset
 - Acute/subacute:
 - infection
 - exacerbation organ failure
 - Chronic: generally over 3 months (!!)

Measuring edema

Brodovicz et al CM&R 2009

- Cross-sectional study of 20 patients
- Compared
 - 0 to 4 (0, 2 mm, 4 mm, 6 mm, 8 mm) at 3 sites
 - Patient questionnaire
 - Ankle circumference (tension-controlled measuring tape)
 - Figure of 8 (as above but 8 measurement sites)
 - Edema testers: plastic plate with holes/bumps compressed with BP cuff to 55 mmHg for 2 minutes
 - Estimate leg volume
 - Water displacement
- Ankle circumference most reliable AND feasible as is MD assessment

Is this heart failure?

Heckman et al Can Geriatr J 2013

- Risk factors?
 - History of HF or coronary artery disease
 - Prescribed beta-blockers, diuretics
- Classical features of heart failure
 - Exertional dyspnea
 - Orthopnea and paroxysmal nocturnal dyspnea
 - Edema is not specific
- Atypical features: ANEWLEAF

Clinical Characteristic	Full Model		Reduced Model				
	AOR (95% CI)	p value	AOR (95% CI)	p value	c-statistic	IDI	p value
Admission assessment history of:							
HF	11.65 (4.55, 29.83)		13.66 (6.61, 28.24)	<0.0001	0.910	0.02	0.0682
Fluid on the lungs	1.96 (0.83, 4.65)	0.1254	2.01 (1.04, 3.89)	0.0373			
Peripheral edema	0.87 (0.30, 2.57)	0.8042					
Orthopnea	1.72 (0.69, 4.27)	0.2443	1.76 (0.93, 3.33)	0.0834			
PND	1.03 (0.36, 2.92)	0.9599					
Dyspnea on moderate activity	0.62 (0.21, 1.84)	0.3920					
Dyspnea compared to peers	0.26 (0.07, 0.90)	0.0337					
Dyspnea walking on the level	3.17 (1.01, 9.90)	0.0475					
Dyspnea with ADLs	3.15 (1.07, 9.31)	0.0377					
Dyspnea at rest	0.72 (0.26, 2.02)	0.5336					
Cardiovascular comorbidities:							
Coronary Artery Disease	2.83 (1.12, 7.15)	0.0282	2.83 (1.42, 5.64)	0.0216			
Atrial Fibrillation	1.20 (0.50, 2.91)	0.6809					
Hypertension	0.85 (0.27, 2.66)	0.7752					
Diabetes mellitus	0.83 (0.33, 2.09)	0.6979					
Physical findings: ^a							
Rales on auscultation	0.88 (0.46, 1.69)	0.6988					
Peripheral edema	1.00 (0.54, 1.85)	0.9989					
Third heart sounds	1.19 (0.20, 7.01)	0.8445					
Jugular venous elevation	0.76 (0.08, 7.31)	0.8116					
Admission HF medications:							
Furosemide	3.70 (1.52, 9.02)	0.0040	2.11 (1.12, 3.98)	0.0216			
ACE inhibitor	1.20 (0.54, 2.64)	0.6575					
β-blocker	2.60 (1.15, 5.85)	0.0216	2.09 (1.10, 3.94)	0.0234			
Digoxin	1.41 (0.43, 4.59)	0.5716					

Hx of HF:

Fluid on the lungs

Coronary artery
disease

Furosemide

β-blocker

A-N-E-W-L-E-A-F: For Personal Support Workers

Adapted from Harrington 2005

- A** Agitation, anxiety (especially if new)
- N** Nights are bad: trouble breathing, urinating more
- E** Edema (swelling you can leave fingerprints in)
- W** Weight gain (from water retention)
- L** Light-headed, dizzy
- E** Extreme trouble breathing lying flat
- A** Abdomen – belly bloated, pain, not hungry
- F** Fatigue, tired

Boston Criteria

- Boston criteria
 - *"definite" = 8 to 12*
 - *"possible" = 5 to 7*
 - *"unlikely" <5*

History	Dyspnea at rest	4
	DOE on level ground	2
	DOE on climbing	1
	Orthopnea	4
	PND	3
Physical exam	HR > 110	2
	JVP >6 cmH2O	2
	JVP >6 cmH2O +HM or LEE	3
	Crackles – basilar	1
	Crackles - > basilar	2
	Wheeze	3
	S3	3
CXR	alveolar pulmonary edema	4
	Interstitial pulmonary edema	3
	Bilateral pleural effusions	3
	Incr CMW >0.5	3
	Incr upper flow redistribution	2

Are Natriuretic peptides useful in LTC?

Homar et al, Heart Failure Reviews 2021

- Comorbidities and age raise NP levels: atrial fibrillation, renal failure, sarcopenia
- Systematic review of use of BNP for screening and diagnosis of HF in LTC residents
- 4 studies:
 - 1104 residents, mean age 82.5 years, 69% women
 - Proportion with HF (clinical + echo): rose from 17% to 29%
 - Mean NT-proBNP 1074 pg/ml overall, and 2409 pg/ml HF confirmed
- ***Proposed*** cut-offs for NT-proBNP
 - rule out HF: 230 to 760 pg/ml
 - rule in HF: 500 to 900 pg/ml

Is POCUS useful in LTC for heart failure?

Popat et al J Cardiol 2026

- I found one review (Abramson JAMDA 2025) of POCUS in LTC but did not focus on HF
- Other reviews in other sectors suggest POCUS can be specific and sensitive depending on what findings are sought
 - Lungs: interstitial edema in 2+ lung zones, effusions
 - Heart: Ejection fraction, E/A ratio (diastolic function)
 - IVC collapsibility
- Devices are cheaper
- Training required

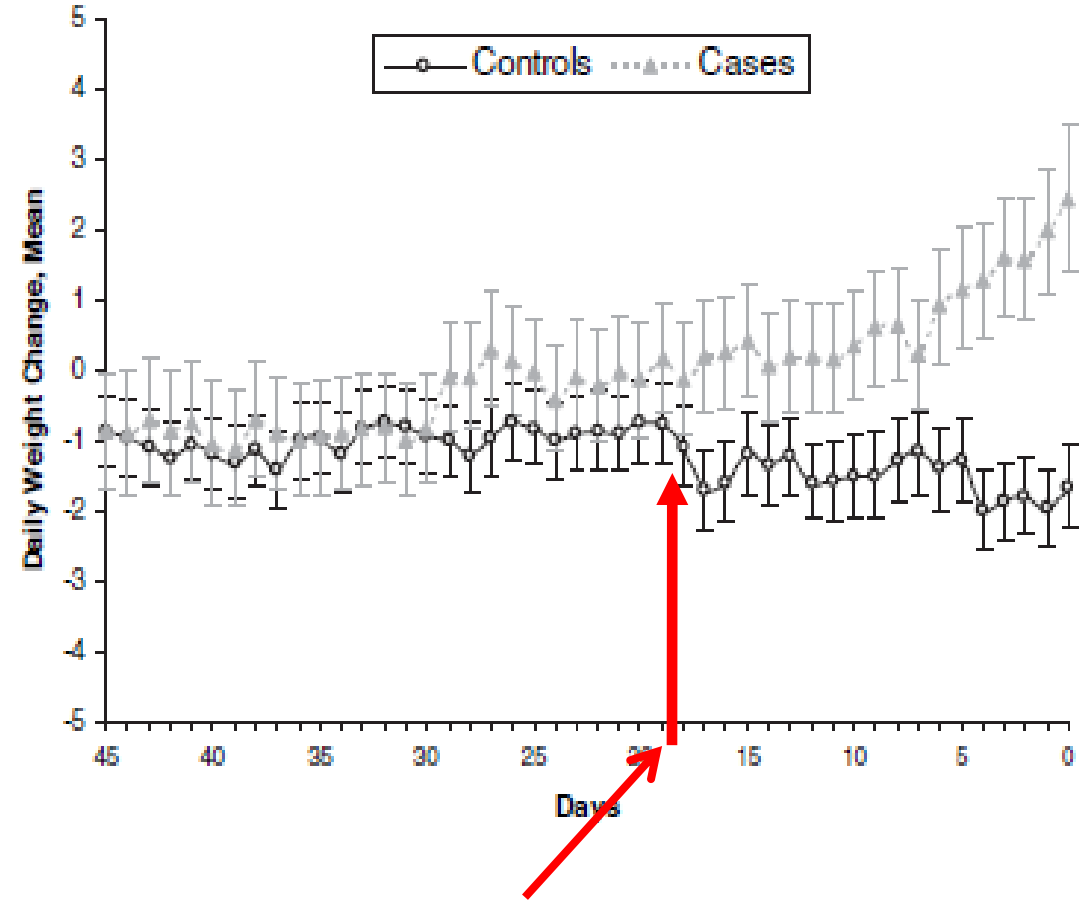
Treatment of heart Failure

- Restore euvolemia: diuretics
- Optimize GDMT:
 - As GDMT doses increase, ***diuretic needs will likely decrease***
 - Changes in blood pressure and rising urea/creatinine levels as GDMT doses increase suggest volume depletion and need to reduce diuretic

Monitoring symptoms and weight change are critical

Chaudry Circ 2007

- Case control study of HF patients in telemonitoring program
 - 134 with HF hospitalization, 135 without
 - Weights diverge 30 days prior to admission ($p < 0.001$)



20 days!!!

Assessing volume status

Robinson & Weber JAMDA 2004

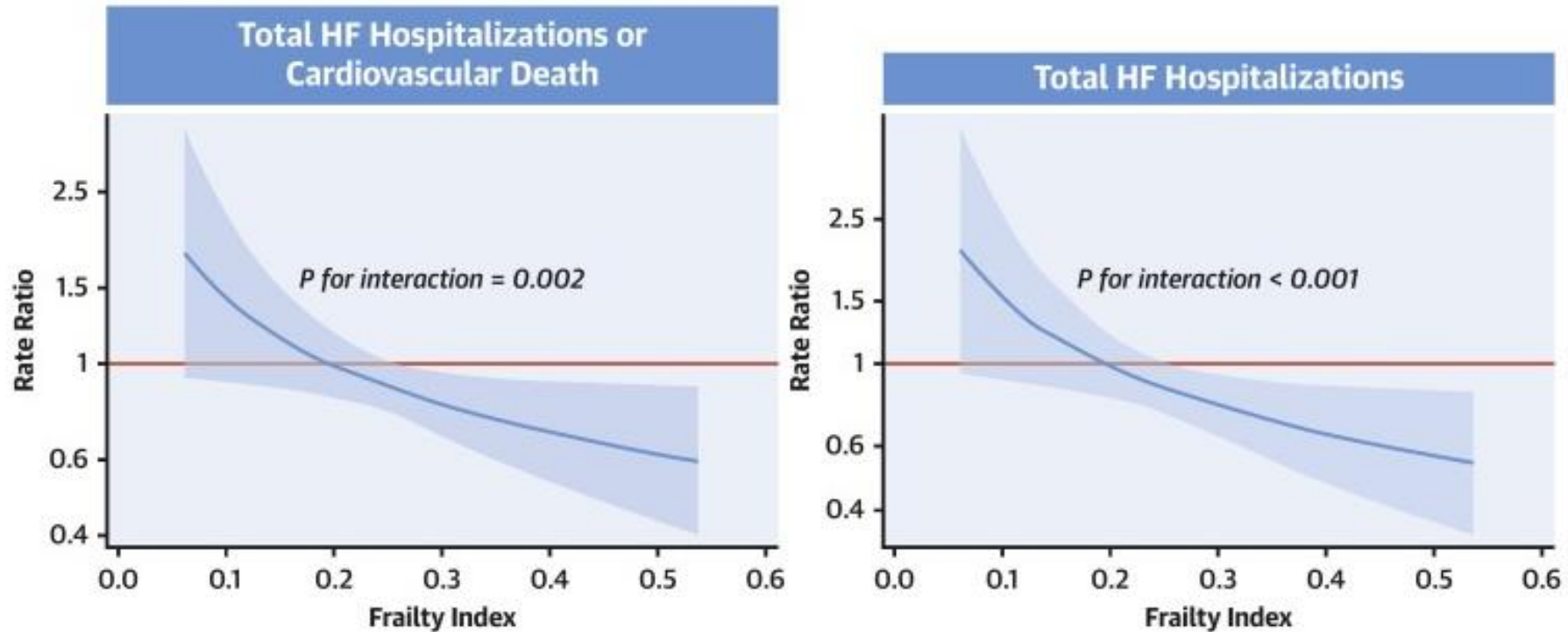
- Need to know dry weight
- Resident may be volume depleted if
 - orthostatic hypotension develops
 - BUN/creatinine ratio starts to rise
 - may occur if GI bleed or decompensated HF
 - edema is reduced
 - incompletely if right heart failure/COPD
 - JVP low/flat
- Likely at dry weight if symptoms optimal for resident and one or more volume depletion indicator is present

Cornerstones of GDMT

- HFrEF: ARNI>ACE/ARB, beta-blocker, SGLT2i, MRA
- HFpEF: SGLTi, MRA
 - (+/- diuretics and others)
- Clinical pearls:
 - **Always** measure orthostatic vitals
 - Diuretic requirements may decrease as GDMT are optimized

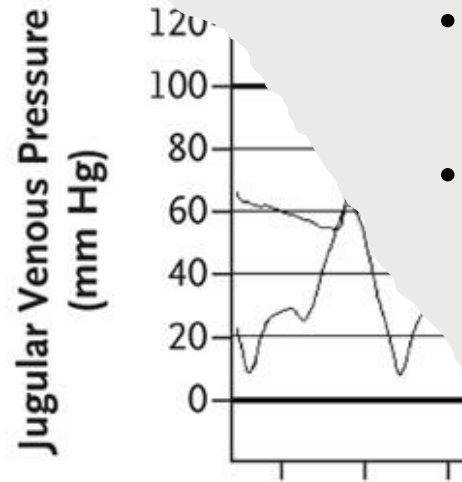
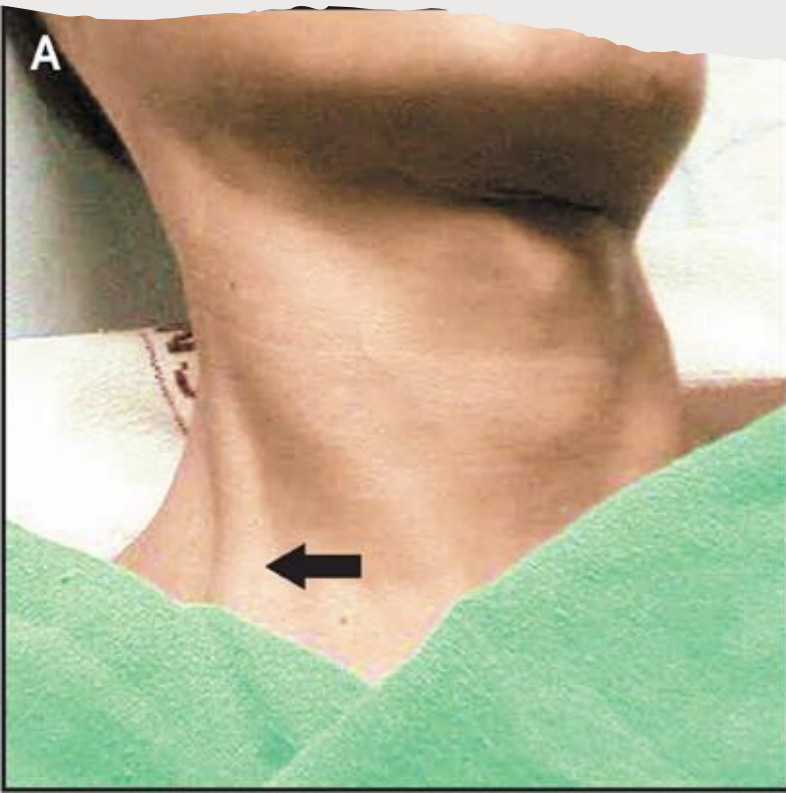
Frailty may not be a contraindication

CENTRAL ILLUSTRATION: Effects of Sacubitril/Valsartan Compared With Valsartan According to the Frailty Index



Is there pulmonary hypertension?

- Commonly associated conditions
 - COPD
 - Interstitial lung disease
 - Sleep apnea (if severe)
 - Hypoventilation: severe thoracic deformity, neuromuscular disease (e.g. ALS)
 - Cardiac: HF, mitral valve disease
 - Chronic thromboembolic disease



NEJM 2012;366(2)

- Clinically: often tricuspid regurgitation
- Echocardiogram helpful: elevated RA, RV pressure, and **RV systolic function**

Managing fluids in setting of pulmonary hypertension

- Address an underlying cause if possible and consistent with goals of care (e.g. HF, severe apnea, COPD, offending medications)
- It may NOT be possible to completely eliminate edema
 - Over-diuresis can decrease Right Ventricular preload and severely decrease RV output
 - Leads to hypotension and pre-renal failure
- In addition to edema, monitor orthostatic vitals, BUN/creatinine ratio, weights (more on this later)

Hypoalbuminemia

Braunwald and Loscalzo, Chapter 36, Harrison's Textbook of Internal Medicine, 17th Ed.; Cabrerizo et al Maturitas 2015

- Severe malnutrition
- Protein-losing enteropathy
- Liver disease
- Nephrotic syndrome
- Sarcopenia/advanced frailty
- Mortality risk in LTC ADL and mobility problems is 7.5 (men) to 12.5 (women) times higher
- ***Treat underlying cause if possible AND consistent with goals of care***

Bilateral cellulitis

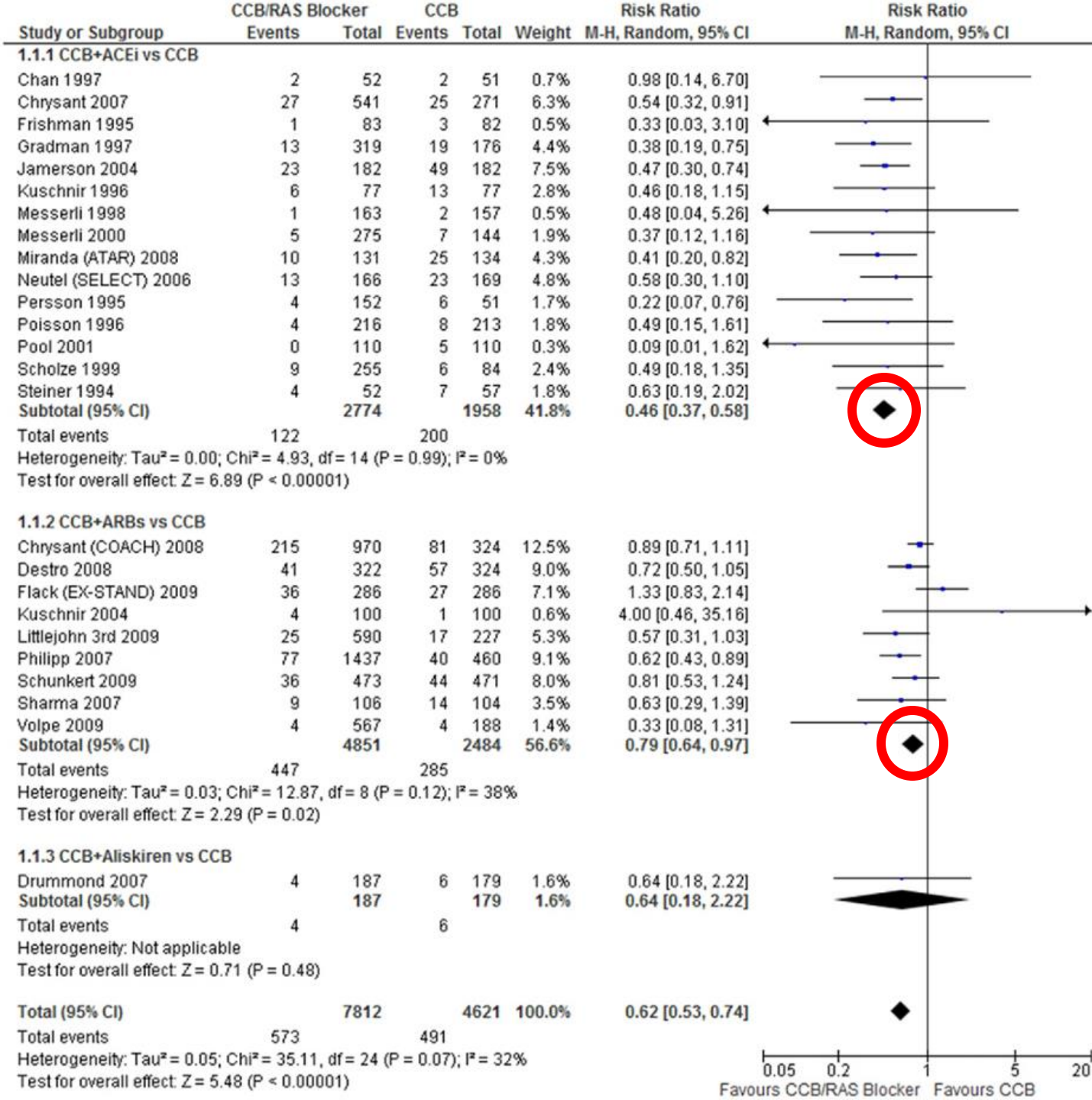
Chuang et al, Int J Gen Med 2022

- Rare
- Systematic review 1990 to March 2022: 13 case reports
- Usual skin culprits more common
- Immunosuppression and chronic organ failure common
- Limited guidance on treatment: authors suggest cultures may be helpful if wounds present

Stasis dermatitis

Yosipovitch et al, Am J Clin Derm 2023; Ankle Brachial Index: Quick Reference Guide for Clinicians
Journal of Wound, Ostomy and Continence Nursing [39\(2S\):p S21-S29, March/April 2012.](#)

- Full review beyond scope of this talk
- Compression is cornerstone of edema management as the cause is venous insufficiency: 60 mmHg (median 30 mm Hg)
 - Arterial dopplers recommended to rule out severe PVD
 - ABI between 0.5 and 0.8: reduce compression to 23-33 mmHg
 - **(yes, they will need help)**
- Diuretics may be indicated for severe edema compromising integrity of epidermis



Pharmacotherapy pearls!

Makani et al am J Med 2011

- Edema incidence 11%
- Calcium channel blockers combined with RAAS inhibitor reduces edema by 38% and CCB withdrawal rate by 62%.
- ACEi > ARB?

Gabapentinoids

Park et al JAMA Netw Open 2025; Tesfaye et al, Lancet 2022; Ates et al Cochrane Database Syst Rev 2026

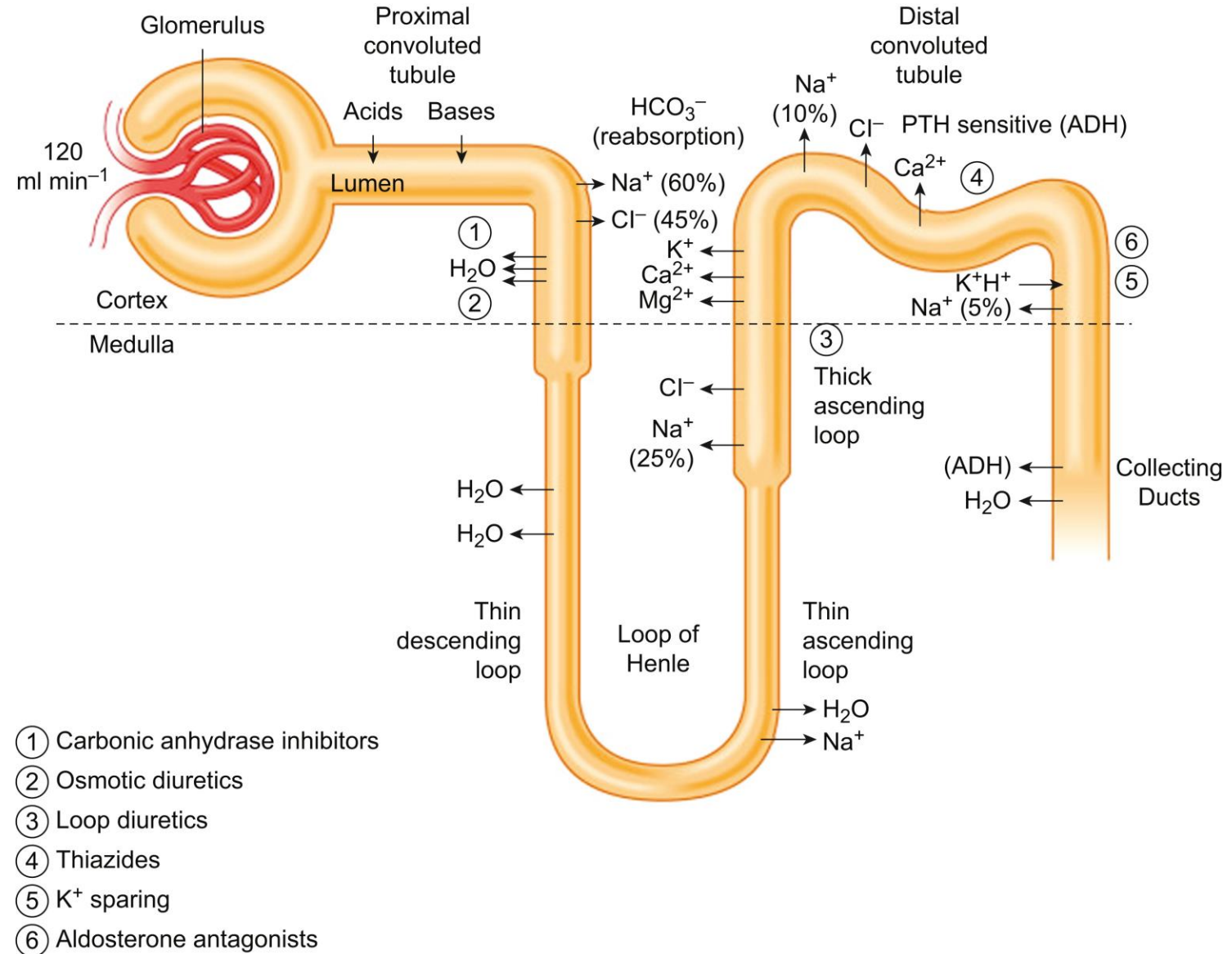
- Retrospective cohort of 246,237 Medicare beneficiaries
 - 18622 new uses of pregabalin 18.2/1000 p-y new Dx HF
 - 227615 new users of gabapentin 12.5 /1000 p-y new Dx HF
- AHR overall 1.48 (1.19-1.77)
- AHR if CV risk 1.85 (1.38-2.47)
- Duloxetine many have similar efficacy for diabetic neuropathy
- Cannabinoids may offer relief but evidence is low quality

Diuretics

Shrestha et al, 2023, Bond et al, StatPearls, NLM 2023
Bell and Mandalia BJAE
2022[https://www.bjaed.org/article/S2058-5349\(22\)00033-6/fulltext](https://www.bjaed.org/article/S2058-5349(22)00033-6/fulltext)

Metolazone

- “thiazide like”: acts at same site but different structure
- Can be used as adjunct to loop diuretic, even with low GFR
- Duration: 24 hours
- Profound diuresis: closely monitor
 - Orthostatic hypotension
 - K, Mg, Uric acid
 - BUN/creatinine

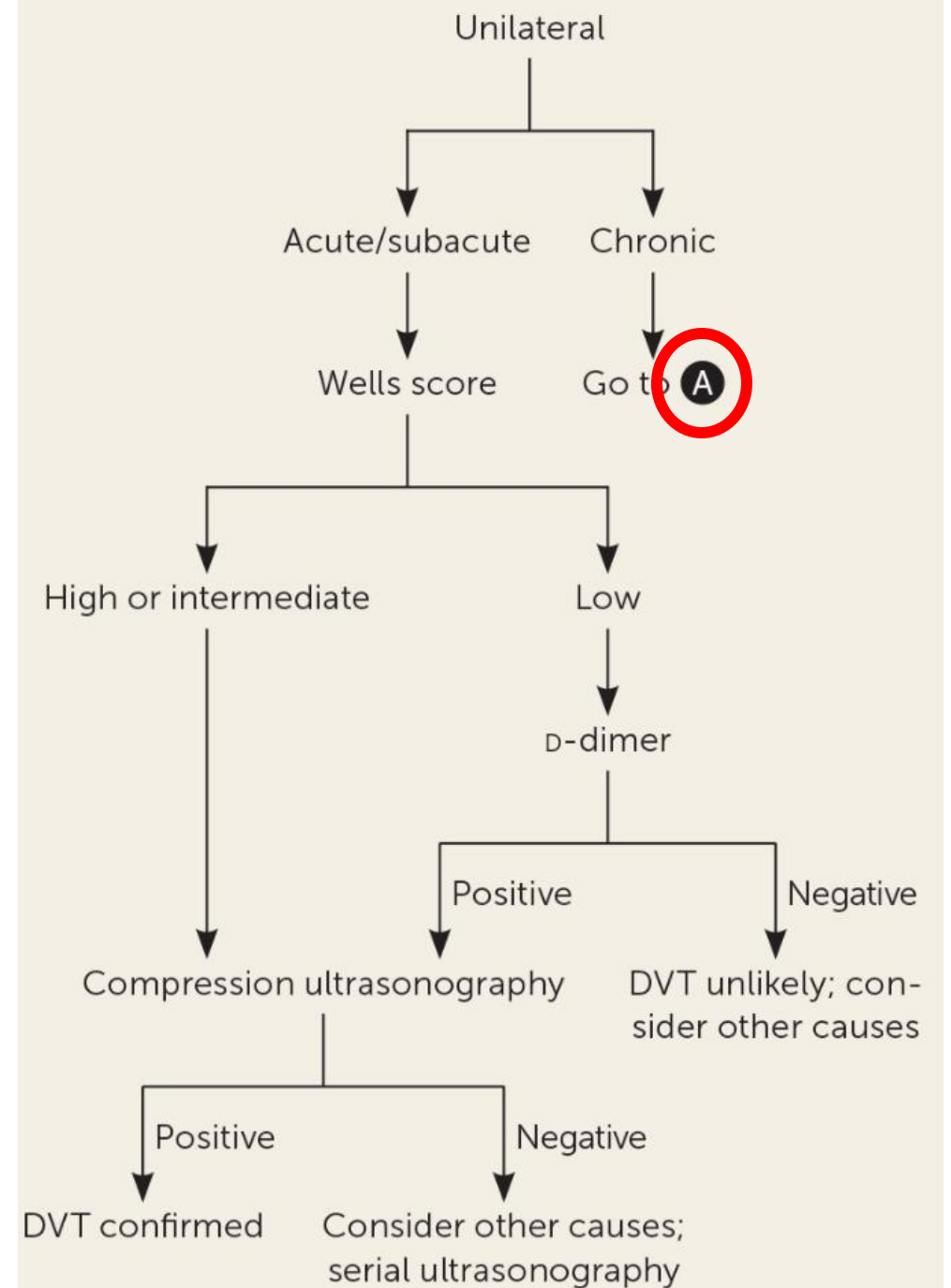


Putting it all together

Clinical assessment

Patel et al, Am Fam Phys 2022

- Location and timing
- Unilateral or not
- Acute/subacute (< 3 months) or not
- A = Duplex ultrasound with reflux



Bilateral edema

- Consider
 - Heart failure
 - COPD or chronic lung disease
 - Sleep apnea
 - Liver or renal disease
- Physical examination, including
 - Vitals, including weight
 - Volume assessment
 - CV, GI, lung
 - Edema: extent, epidermal integrity
- Medication review
- Labs:
 - BUN, creatinine, electrolytes
 - Liver function
 - TSH
 - Albumin, Total protein
 - +/- NT-proBNP
 - ECG
- CXR
- ECHO with RVSP, RV function, mitral valve
- Consider: sleep study, duplex ultrasound with reflux, PFTs

MDS outputs can help

- | | | |
|----------------|--------------------------------------|--|
| • CPS 2/6 | ~MMSE 19 | • Risk of delirium, atypical symptoms |
| • ADLH 4/6 | Extensive assistance with locomotion | • Legs heavy? Help with compression stockings? Dypnea? |
| • CHESS 2/5 | low health instability | • With PURS, raises possibility of HF or COPD |
| • DRS 2/14 | mild symptoms | |
| • FRS 6/8 risk | 7% annual hip # | • Fracture will complicate everything |
| • Pain 0/4 | No pain | |
| • PURS 3/8 | prior wound, dyspnea | • May help weaning analgesics |
| | | • Skin integrity at risk |

Management

- Target underlying **causes**
 - If possible
 - If consistent with goals and wishes
- Medication optimization:
 - Amlodipine and ACEi for hypertension
 - Alternatives to gabapentinoids (are they on acetaminophen?)
- Compression and local measures for venous insufficiency
 - Judicious diuretics to protect skin, optimize impact on ADLs, mobility
 - Metolazone: use as needed and sparingly

Thank you!