(PBL) Acute and Chronic Heart Failure

Scott Kinkade, MD, MSPH, EdD

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Dr. Kinkade is the medical director for the family medicine inpatient service at University Hospital in Columbia, Missouri. He earned his medical degree from the University of Texas School of Medicine in Houston and completed a family medicine residency at Martin Army Community Hospital at Fort Benning, Georgia. Previously, he was director of undergraduate medical education in the military at Fort Hood, Texas, and at the University of Texas Southwestern Medical School in Dallas. He was a master educator fellow at the University of Missouri and earned a doctorate in education from the University of North Texas.
Learning Objectives

1. Practice applying new knowledge and skills gained from Acute and Chronic Heart Failure sessions, through collaborative learning with peers and expert faculty.

2. Identify strategies that foster optimal management of acute and chronic heart failure within the context of professional practice.

3. Formulate an action plan to implement practice changes, aimed at improving patient care.

Associated Sessions

• Acute and Chronic Heart Failure
Case 1: Chief Complaint

“I’m here for my blood pressure”

History of Present Illness

54 year-old African-American man here for routine follow up of HTN. He is not checking blood pressures at home.

He is somewhat limited in his ability to walk by knee pain, but does not report any angina or shortness of breath.
Past Medical History

Hypertension
Osteoarthritis of the knee
Depression

Medications, Allergies

HCTZ 25 mg daily
atenolol 50 mg daily
fluoxetine 20 mg daily
naproxen sodium 500 mg bid

NKDA
Immunizations
Up-to-date

Family History
Father – CAD s/p CABG at age 70
Mother – hypertension, hypothyroidism
Brother – CAD s/p PCI at age 57
Social History

Married, 2 children in high school. Works in a bank, mostly sedentary.
Quit smoking 20 years ago after 5 pack-year history
Drinks 2-4 beers per week

Physical Examination

Height 72”, weight 248, BMI 33
BP 148/90, P 72, RR 14, O2 sat 96%, afebrile
Normal mental status
Head/Neck – normal, no JVD
CV – RRR, no murmur, (+) S4, no edema
Chest – clear, unlabored
Abd – soft, no masses or bruits
Laboratory/Radiology

BUN 25, Cr 1.2 (both up from his baseline)
Na  138, K+  3.6, Glucose 115
Total Chol 240; Trig 272

ECG next slide
Q1 What does the ECG show and how does it relate to Heart Failure?

Q1: Answer

Left ventricular hypertrophy

23 mm

20 mm
Q1: Answer

LV wall thickness moderately increased
Concentric hypertrophy of the LV
LV systolic function normal
LV ejection fraction: 65%
Doppler parameters consistent with class 2 diastolic dysfunction.
Increased mean LA pressure.
LA is moderately dilated

You decide to order an echocardiogram

LV wall thickness moderately increased
Concentric hypertrophy of the LV
LV systolic function normal
LV ejection fraction: 65%
Doppler parameters consistent with class 2 diastolic dysfunction.
Increased mean LA pressure.
LA is moderately dilated
Q2

Does this patient have heart failure? If so, what stage or class? Do you recommend any treatment?

Current meds:
- HCTZ 25 mg daily
- atenolol 50 mg daily
- fluoxetine 20 mg daily
- naproxen sodium 500 mg bid

Q2

**ACC/AHA heart failure staging**

A: High Risk for HF, no structural damage or signs/symptoms

B: Structural damage, no signs/symptoms

C: Structural damage with prior or current signs/symptoms

D: Refractory requiring specialized intervention
## Stage B HF recommendations

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Level 1</th>
<th>Level 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>In pts with a history of MI and reduced EF, ACE inhibitors or ARBs should be used</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>In pts with MI and reduced EF, evidence-based beta blockers should be used</td>
<td>I</td>
<td>B</td>
</tr>
<tr>
<td>In pts with MI, statins should be used to prevent HF</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>In pts with structural cardiac abnormalities, including LV hypertrophy, in the absence of a history of MI or ACS, blood pressure should be controlled in accordance with clinical practice guidelines for hypertension to prevent symptomatic HF</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>ACE inhibitors should be used in all pts with a reduced EF to prevent HF</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>Beta blockers should be used in all pts with a reduced EF to prevent HF</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>An ICD is reasonable in pts with asymptomatic ischemic cardiomyopathy who are at least 40 d post-MI, have an LVEF ≤30%, and on GDMT</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>Nondihydropyridine calcium channel blockers may be harmful in patients with low LVEF</td>
<td>III: Harm</td>
<td>C</td>
</tr>
</tbody>
</table>

## Case 2: Chief Complaint

“I get short of breath easily”
History of Present Illness

64 year-old white man presenting to the ED with complaints of shortness of breath on exertion and weight gain (10-15 pounds)

6 months ago he could walk 10 blocks. Now he can only walk 1 block.

Past Medical History

Hypertension
Hyperlipidemia
OA of the shoulder
Medications, Allergies

Atorvastatin 20 mg
Lisinopril 20 mg/HCTZ 12.5 mg
Ibuprofen 400 mg TID

NKDA

Immunizations

Up-to-date
Family History

Father – multiple myeloma age 78
Mother – hypertension, T2 DM, ESRD
No known family hx of CAD or HF

Social History

Retired car dealer. Married.
Non-smoker
Drinks 1 Hurricane per day
Physical Examination

Height 70”, weight 228, BMI 31
BP 134/78, P 72, RR 14, O2 sat 93%, afebrile
Normal mental status
Head/Neck – normal, JVD to angle of the jaw at 45°
CV – RRR, no murmur, 2+ edema above ankle
Chest – slightly labored, rales lower 1/3 lung field
Abd – soft, no masses or bruits
Laboratory/Radiology

Na  134, K+  3.8, Glucose 122  
BUN 18, Cr 0.9  
Total Chol 178; Trig 122; HDL 41; LDL 107  
NT-proBNP 2,888   Trop I <0.01

CXR – Mild cardiomegaly, pulmonary edema, small bilateral effusions

Additional studies

ECG – NSR, no ischemic changes

Echocardiogram:
Mildly dilated LV, LVEF 30%, normal wall motion, class 1 diastolic dysfunction
Q3

What are your initial management steps for the patient?

Q4: Management of acute decompensated HF

1. IV diuresis with furosemide
2. Daily weights, BMP
3. ? Salt, fluid restriction
4. Evaluate for etiology or reason for decompensation
5. D/C offending meds
6. Optimize evidence-based therapies
7. Patient education
ADHF - diuresis

- IV preferred
- Higher dose more effective than lower dose
- Goal 3-5L per day during acute phase (1-3L net deficit)
- Worsening of renal function does not portend worse prognosis

ADHF – offending meds

- NSAIDS, COX 2 inhibitors
- Calcium-channel blockers
- Tricyclic antidepressants
- Thiazolidinediones
- Dipeptidyl peptidase-4 inhibitors
- Alpha 1-blockers – doxazosin, terazosin
- Anti-cancer drugs
- Sympathomimetic stimulants
### Sodium containing meds

- Kayexelate 60 ml 1200 mg/60 ml
- Pip/tazo 3.375 gm Q6 800 mg
- Metronidzaole 500 IV Q8 938 mg
- Colyte, Golytely 1L 1.46 g

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### Case 2: continued

By day 4 you have diuresed your patient 9L and his weight drops from 228 → 208 lbs.

He does not have elevated JVP or edema. He has no orthopnea or oxygen requirement.

**BMP:**

<table>
<thead>
<tr>
<th>Na</th>
<th>K</th>
<th>Bun</th>
<th>Cl</th>
<th>HCO3</th>
<th>Cr</th>
</tr>
</thead>
<tbody>
<tr>
<td>137</td>
<td>3.7</td>
<td>18 → 21</td>
<td>101</td>
<td>25</td>
<td>0.9 → 1.1</td>
</tr>
</tbody>
</table>
Q4

What med change(s) do you want to make at D/C?

Admission meds:
Atorvastatin 20 mg
Lisinopril 20 mg/HCTZ 12.5 mg
Ibuprofen 400 mg TID

HFrEF – ACEI and ARB

<table>
<thead>
<tr>
<th>Drug</th>
<th>Initial Daily Dose(s)</th>
<th>Target Doses(s)</th>
<th>Mean Doses Achieved in Clinical Trials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACE Inhibitors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Captopril</td>
<td>6.25 mg 3 times</td>
<td>50 mg 3 times</td>
<td>122.7 mg/d</td>
</tr>
<tr>
<td>Enalapril</td>
<td>2.5 mg twice</td>
<td>10 to 20 mg twice</td>
<td>16.6 mg/d</td>
</tr>
<tr>
<td>Lisinopril</td>
<td>2.5 to 5 mg once</td>
<td>20 to 40 mg once</td>
<td>32.5 to 35.0 mg/d</td>
</tr>
<tr>
<td><strong>ARBs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Candesartan</td>
<td>4 to 8 mg once</td>
<td>32 mg once</td>
<td>24 mg/d</td>
</tr>
<tr>
<td>Losartan</td>
<td>25 to 50 mg once</td>
<td>150 mg once</td>
<td>129 mg/d</td>
</tr>
<tr>
<td>Valsartan</td>
<td>20 to 40 mg twice</td>
<td>160 mg twice</td>
<td>254 mg/d</td>
</tr>
</tbody>
</table>

Circulation 2017; 136(6):e137-e161
Case 3

64 yo retired car dealer, hospitalized for newly diagnosed heart failure 3 months ago and seen in clinic twice since then.

Now with c/o occasional PND and mild swelling in lower extremities. He can walk 4-5 blocks on level ground without symptoms.
Case 3: Medications

Lisinopril 20 mg daily  
Furosemide 20 mg daily  
Carvedilol 12.5 mg 2x/day  
Atorvastatin 20 mg daily  
Tylenol 100 mg 2-3x/day

Case 3: Physical Exam

Height 70”, weight 198  
BP 118/68, P 68, RR 14, O2 sat 96%  
Normal mental status  
Head/Neck – normal, No JVD at 45°, no HJR  
CV – RRR, no murmur, 1+ non pitting edema ankles  
Chest – clear
Case 3: Labs

Na 138  Cl 104  Bun 19
K+ 4.1  HCO3 27  Cr 1.2

NT-pro BNP 488 ng/dl

Q5: What is the best next step?

A. Increase lisinopril to 40 mg daily
B. Increase carvedilol to 25 mg 2x/day
C. Add spironolactone 12.5 mg daily
D. Add hydralazine 25 mg and isosorbide dintrate 20 mg 3x/daily
E. Add sacubitril/valsartan 24/26 mg 2x/daily
Minimizing the Risk of Hyperkalemia with Aldosterone Antagonists

- The risk increases with serum creatinine >1.6
- In elderly or low muscle mass use creatinine clearance >30
- Don’t initiate with serum K+ >5.0 mEq/L.
- Risk of hyperkalemia is increased with higher doses of ACE inhibitors
- K+ supplements should be discontinued or reduced

Recommended to check K+ and creatinine in 3 d and at 1 wk after initiating therapy and at least monthly for the first 3 mo

Circulation. 2013;128:e240-e327
Your patient now asks to start sacubitril/valsartan. Is he a candidate? If so, are there any precautions?

### 2017 Update: ARNI

<table>
<thead>
<tr>
<th>COR</th>
<th>LOE</th>
<th>Recommendations</th>
<th>Comment/ Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>ACE-I: A</td>
<td>The clinical strategy of inhibition of the renin-angiotensin system with ACE inhibitors (Level of Evidence: A), OR ARBs (Level of Evidence: A), OR ARNI (Level of Evidence: B-R) in conjunction with evidence-based beta blockers, and aldosterone antagonists in selected patients, is recommended for patients with chronic HFrEF to reduce morbidity and mortality.</td>
<td>NEW: New clinical trial data prompted clarification and important updates.</td>
</tr>
</tbody>
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Circulation 2017; 136:e137-e161
### 2017 Update: ARNI

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<th>Comment/ Rationale</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>ARNI: B-R</td>
<td>In patients with chronic symptomatic HFrEF NYHA class II or III who tolerate an ACE inhibitor or ARB, replacement by an ARNI is recommended to further reduce morbidity and mortality.</td>
<td>NEW: New clinical trial data necessitated this recommendation.</td>
</tr>
</tbody>
</table>

Circulation 2017; 136:e137-e161

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</thead>
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<tr>
<td>III: Harm</td>
<td>C-EO</td>
<td>ARNI should not be administered to patients with a history of angioedema.</td>
<td>NEW: New clinical trial data.</td>
</tr>
<tr>
<td>III: Harm</td>
<td>B-R</td>
<td>ARNI should not be administered concomitantly with ACE inhibitors or within 36 hours of the last dose of an ACE inhibitor.</td>
<td>NEW: Available evidence demonstrates a potential signal of harm for a concomitant use of ACE inhibitors and ARNI.</td>
</tr>
</tbody>
</table>

Circulation 2017; 136:e137-e161
Prescribing Sacubitril/Valsartan

- Don’t use with:
  - ACEI in previous 36 hours
  - Pregnancy
  - History of angioedema
- Caution with low blood pressure
- Consider decreasing diuretic by 50%
- 24mg/26mg - 49mg/51mg - 97mg/103mg

Case 3 continued

Now your 64 yo male with HFrEF is relatively stable. He has no PND and can ambulate 1-2 blocks.
Meds:
carvedilol 25 mg 2x/day
sacubitril/valsartan 49/51 mg 2x/day
spironolactone  25 mg 1x/day
furosemide 20 mg 1x/day
Exam: BP 115/64, P 84, Lungs clear, trace LE edema
ECG: NSR, LVH, QRS 105 ms
Echo: LVEF has increased from 30% to 40%

Your patient asks if he is doing everything he can for his heart failure. You think back to these talks and review your guidelines to see if there is anything else you should be doing for him.

Q7

Your patient asks if he is doing everything he can for his heart failure. You think back to these talks and review your guidelines to see if there is anything else you should be doing for him.
NYHA III-IV, in black patients → Hyrdral-Nitratres (COR I)

NYHA II-III, LVEF ≤ 35 % (> 1 yr expected survival, 40d post MI) → ICD (COR I)

NYHA II-IV LVEF ≤ 35%, NSR & QRS > 150 ms with LBBB pattern → CRT or CRT-D (COR I)

NYHA II-IV LVEF ≤ 35%, NSR HR > 70 bpm on maximally tolerated beta-blocker dose → Ivabradine (COR IIa)

Recommendations: GDMT for Stage C HFrEF

1. ACE-inhibitor (or ARB if ACEI side effects)
2. Evidence based Beta-blocker
3. Aldosterone Antagonist
4. Sacubitril/valsartan
5. Hydralazine/isosorbide dinitrate
6. Cardiac resynchronization therapy
7. Implantable cardiac defibrillator
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Questions