Advanced Concepts in Heart Failure in Patients with Altered Kidney Function

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Objectives

- Explore new areas of understanding of the pathophysiology of heart failure in the setting of altered kidney function
- Differentiate between preserved vs. decreased LVEF
- Discuss the levels of severity of heart failure
- Distinguish AHA and NYHA classifications systems
- Identify treatment goals for heart failure patients with altered kidney function

Heart Failure (HF)

- Complex clinical syndrome that results from an structural or functional impairment of ventricular filling or ejection of blood
- HF can affect the right and left ventricles, but left ventricles abnormalities are the most common
- Despite recent advances in therapies for HF, the overall mortality rates remain approximately 50% within 5 years of diagnosis and has stayed constant in recent years

(Yancy et al., 2013)

New Terms and Changing Definition

- HF was once called congestive heart failure
- Historically, HF described only ejection problems from the left ventricle.
- Now HF is used to describe problems with filling of the left ventricle and ejection of blood from the left ventricle

(Wick, 2017)

More New Terms

- The 2 major types of heart failure have been renamed
- Systolic HF is now called heart failure with reduced ejection fraction (HFrEF). HFrEF is defined as HF with an EF <40%. Normal EF is 55-60% in adults
- Diastolic HF is called heart failure with preserved ejection fraction (HFpEF)

(Wick, 2017)

Definition of Heart Failure

Classification	Ejection Fraction	Description
I. Heart Failure with Reduced Ejection Fraction (HFrEF)	≤40%	Also referred to as systolic HF. Randomized clinical trials have mainly enrolled patients with HFrEF and it is only in these patients that efficacious therapies have been demonstrated to date.
II. Heart Failure with Preserved Ejection Fraction (HFpEF)	≥50%	Also referred to as diastolic HF. Several different criteria have been used to further define HFpEF. The diagnosis of HFpEF is challenging because it is largely one of excluding other potential noncardiac causes of symptoms suggestive of HF. To date, efficacious therapies have not been identified.
a. HFpEF, Borderline	41% to 49%	These patients fall into a borderline or intermediate group. Their characteristics, treatment patterns, and outcomes appear similar to those of patient with HFpEF.
b. HFpEF, Improved	>40%	It has been recognized that a subset of patients with HFpEF previously had HFrEF. These patients with improvement or recovery in EF may be clinically distinct from those with persistently preserved or reduced EF. Further research is needed to better characterize these patients.

(AHA, 2013)

Causes of HF

- Ischemic heart disease (most common cause)
- Diabetic cardiomyopathy
- Thyroid disease associated with atrial fibrillation and increased heart rates
- Obesity
- Growth hormone deficiency
- Toxic causes (cocaine, chemotherapy drugs, and ETOH)
- Tachycardia-induced cardiomyopathy (can be reversible)

More Causes of HF

- Inflammatory illnesses that impact the heart (myocarditis, HIV, and Chagas disease)
- Non-infectious causes: hypersensitivity myocarditis, rheumatoid and connective tissue disorders, iron overload, amyloidosis, sarcoidosis, and stress
- Stress cardiomyopathy is an acute, reversible cause of HF

(Wick, 2017)

A Closer Look at Ischemic Causes

- May occur after an MI or in patients with CAD
- Left ventricle becomes ischemic from decreased blood supply and a decrease in cardiac contractility occurs
- HFrEF results

HF Classifications

- American College of Cardiology Foundation (AACF) and the American Heart Association (AHA) has staged heart failure based on the pathophysiology of the heart and symptoms of HF
- The New York Heart Association (NYHA) classifications are based on only symptoms

Classification of Heart Failure

ACCF/AHA Stages of HF		NYHA Functional Classification	
A	At high risk for HF but without structural heart disease or symptoms of HF.	None	
B	Structural heart disease but without signs or symptoms of HF.	I	No limitation of physical activity. Ordinary physical activity does not cause symptoms of HF.
C	Structural heart disease with prior or current symptoms of HF.	I	No limitation of physical activity. Ordinary physical activity does not cause symptoms of HF.
		II	Slight limitation of physical activity. Comfortable at rest, but ordinary physical activity results in symptoms of HF.
		III	Marked limitation of physical activity. Comfortable at rest, but less than ordinary activity causes symptoms of HF.
		IV	Unable to carry on any physical activity without symptoms of HF, or symptoms of HF at rest.
D	Refractory HF requiring specialized interventions.		

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Role of the Renin-Angiotensis-Aldosterone System (RAAS)

- RAAS is a hormone system that regulates BP and fluid balance in the response to lowered cardiac output associated with HF
- Decreased blood flow to the kidney—renin secreted and angiotensis formed—vasoconstriction occurs—increase in BP
- Increased secretion of aldosterone—retention of salt and water in the kidneys—increased ECF, CO, and arterial pressure—fluid retention occurs and congestion results

(Wick, 2017)

RAAS Blockers

- Drugs that inhibit the renin-angiotensin-aldosterone system (RAAS) are the cornerstone of therapy for cardiovascular and renal disease because they protect against worsening outcomes in the respective target organs
- This classification of medications is used to treat HFrEF
- An aggressive approach for more extensive RAAS blockade with combination of two commonly used RAAS blockers [ACE inhibitors (ACEIs) and angiotensin receptor blockers (ARBs)]—more side affects occur

(Wick, 2017)

Risk Factors for HF

- Hypertension is the most significant risk factor
  - Incidence of HF in 60-89% of patients with HTN (Wilhelmsen et al., 2001)
- DM
- Metabolic syndrome
- Atherosclerosis
- Note: treatment of risk factors can prevent the development of HF (American Diabetes Association, 2012)

Incidence of HF in the U.S.

- Lifetime risk is 20% in American older than 40 y.o.
- 650,000 new cases annually (Djousse, 2009)
- Increased risk with increasing age
- Blacks have the highest risk of HF and white women have the lowest risk (Bahrami et al., 2008)
- HFpEF occurs in about 50% of the patients with HF

Incidence in Patients with CKD

- Left ventricle abnormalities are common in patients with CKD
- ~73% of patients who start dialysis have LVH, 35% have left ventricular dilatations, and 15% have HFrEF
- Dialysis will not improve left ventricular function; in fact to worsens with time on dialysis

(Segall, Nistor, & Covic, 2014)

Symptoms of HF

- Dyspnea and fatigue
- Decompensated HF includes pulmonary congestion, liver congestion, and lower extremity edema
- Regardless of decompensation or not, the patient will often experience dyspnea and fatigue

(Yancy et al., 2013)

Diagnosis of HF

- Through H&P
- The history will assist in determining the cause of HF
- The physical exam will include vital signs, volume status, jugular vein pressure assessment, heart and lung sounds assessment, and assessment for presence or absence of LE edema
- Labs include: CBC, urinalysis, electrolytes, BUN, serum creatinine, glucose, lipid profile, LFTs, and TSH

(Yancy et al., 2016)

Class 1 Recommendations

- Initial work-up:
  - 12-lead EKG
  - CXR
  - 2-D Echocardiogram w/ doppler

Other Diagnostic Considerations

- Non-invasive imaging to detect myocardial ischemia if the patient has a history of suspicion of CAD
- BNP measurement in patients with dyspnea, if diagnosis is uncertain
- Note: in patients with CKD the plasma levels of BNP are affected by decreased GFR and are less predictive

Treatment of HF

- **Stage A**: treatment of HTN and lipid disorders with the goal of lowering the risk of advancing the HF
- Management of comorbid conditions such as obesity, DM, tobacco use, and cardiotoxic agents

(Chobanian et al., 2003)

Treatment of HF (continued)

- **Stage B**: incorporate recommendations for Stage A, the use of medications specific to HF treatment (RAAS, beta-blocker, ARB, etc.), blood pressure control, and management of co-morbid conditions
- Implanted cardiac defibrillators are recommended for patients 40 days post-MI, have an EF <30%, and are on guideline directed medical therapy
- Dietary therapy and lifestyle management education to prevent disease progression

(Strandberg et al., 2009)

Treatment of HF (continued)

- **Stage C**: patients are often hospitalized due to symptoms and with this comes feeling of being scared and overwhelmed
- Self-care education is paramount
  - Mutliple medication management
  - Monitoring wt. and symptoms
  - Na+ restriction
  - Maintain physical activity

(Wick, 2017)

Treatment of HF Stage C (continued)

- ICD is recommended to prevent sudden cardiac death in patients with LVEF <30% or are 40 days post-MI
- Pharmacologic management
  - Same therapies as stage B with a few additional drugs
    - FVE—loop diuretics
- Screening patients for sleep apnea is important
  - 61% of patients have central or obstructive sleep apnea
  - Screening is open performed at diagnosis of HF

(Wick, 2017)

Treatment of HF (continued)

- **Stage D**: identifies patients with advanced HF and progressive and several symptoms despite therapy
- Patients are often restricted in functional capacity and have extreme dyspnea, orthopnea, and fatigue
- LVAD has been offered to patients in this stage as a destination therapy or as a bridge to transplant
- LVAD devices are smaller and lighter
- End-of-life is an important consideration

(Wick, 2017)

Treatment of HFpEF

- Evidence in the management of this population is somewhat limited
- Focus is on BP, HR, and volume control
- Medications often include: ACE inhibitors, beta-blockers, and diuretics
- Management of co-morbidities is required

(Wick, 2017)

HF Considerations for Patients with CKD

- Patients with CKD die from cardiovascular complications and not kidney failure
- "The 2 disease states are so closely linked they share the same risk factors"
- Having one disease increases the risk of developing the other
- HF is associated with decreased kidney function based on low cardiac output

(Wick, 2017)

HF Risk Factors for Patients with CKD

- Hypertension: it is more likely patients with HF will also have hypertensive nephrosclerosis and decreased kidney function (Gupta et al., 2012)
- Medication risks
  - ACE Inhibitors are renoprotective, except for patients with CKD Stage 5 due to the risk of hyperkalemia and are contraindicated for creatinine clearance <30mL/min

2 New Drugs for Patients with CKD and HF

- Ivabradine: inhibits the 1f current in the sinoatrial node and slows the HR. Studies have shown a decrease in hospitalization, but not mortality (Bohm et al., 2015)
- Valsartan/sacubitril: this combination of an angiotensin receptor blocker and neprilysin inhibitor showed a decrease in HF hospitalizations and mortality rates associated with HF. Guidelines recommend using this drug in place of an ACE-I or ARB, not in combination (Voors et al., 2015)

Ivabradine

- Guidelines indicate use of this drug in patients:
  - with symptomatic HF(NYHA Class II and III)
  - on maximum doses of drugs
  - in sinus rhythm with HR >70 (goal of the drug is to slow the HR and increase diastolic time so there is greater ventricular filling and increased SV and CO)
  - should be used in combination with beta-blockers

Valsartan/sacubitril

- There must be a 36-hour washout period between ending the ACE-I and ARB, not to be used in combination due to risk of angioedema and hypotension
- Don't use this drug if the patient has experienced angioedema from an ACE-I or ARB

Health Behaviors for Patients with HF and CKD

- Dietary restriction of sodium, potassium, and phosphorus
  - Nutrition education and meal planning is essential, but challenging
- Avoid NSAIDs due to sodium resorption
- Assess for depression and body image disturbances
- Low health literacy, memory issues, low motivation, and sensory disturbances create learning barriers
- Care coordination is necessary

(Wick, 2017)

Research Abstract #1 (Thirst)

Allida,S., Inglis, S., Davidson, P., Lal, S., Hayward, C., & Phillip, J. (2015). Thirst in chronic heart failure: A review. *Journal of Clinical Nursing*, *24*(7/8), 916-926.

Thirst is a common and troublesome symptom of HF. Despite the prevalence of thirst, there are limited management strategies. Searched 5 data bases for evidence. Yielded 165 citations; 9 studies met inclusion criteria (dx of HF, RCT or thirst was primary or secondary outcome, humans, and English language. Interventions to manage thirst included artificial saliva and chewing gum for patients on hemodialysis, but no other invention studies were located. Researchers concluded that thirst is a frequent and troublesome symptom for individuals with chronic HF. It likely contributes to poor adherence with fluid restrictions. Chewing gum can help alleviate thirst, but investigation in people with HF is needed. Increasing awareness of thirst and interventions to relieve it in clinical practice has the potential to improve the quality of life for people with chronic HF.

Research Abstract #2 (AKI)

Freda, B., Knee, A., Braden, G., Visintainer, P., & Thakar, C. (2017). Effect of transient and sustained acute kidney injury on readmission in acute decompensated heart failure. *American Journal of Cardiology*, *119*, 1809-1814.

AKI is common in HF, yet the impact of onset, timing, and during of AKI is not well studied. For this study, AKI was categorized as transient (T-AKI), sustained (S-AKI), and unknown (U-AKI) duration. The main outcome was 30-day all-cause readmission rate. The study had a sample of 14,017 subjects with acute decompensated HF. Overall, 35.9% of patients developed AKI during hospitalization. An additional 16.5% patients had AKI on admission. Of those developing AKI, 19.8% experienced T-AKI, 42.7% S-AKI, and 37.5% U-AKI. Patients with S-AKI experienced a 1.3-fold greater risk of readmission within 30-days. Patients with T-AKI also experienced a higher rate of readmission.

Research Abstract #3 (CRIC Study)

He, J., Shlipak, M., Anderson, A., et al. (2017). Risk factor for heart failure in patients with chronic kidney disease: The CRIC (Chronic Renal Insufficiency Cohort) Study. *Journal of the American Heart Association*, *6*:e005336. DOI: 10.1161/JAHA.116.005336.

Risk factors for incident heart failure was studied in the 3557 participants in the CRIC Study. This study enrolled participants from 7 centers across the U.S. from 2003 to 2008. During an average 6.3 years of follow-up, 452 participants developed incident HF. Data was collected via a phone call every 6 months to the study participants. Kidney failure was assessed by eGFR (and used to predict HF after adjusting for variables) using serum creatinine, cystatin C, or both, and 24-hour urine albumin excretion. The researchers concluded that cystatin C-based eGFR and albuminuria are better predictors for risk of heart failure compared to creatinine-based eGFR. Anemia, insulin resistance, inflammation, and poor glycemic control are independent risk factors for the development of heart failure among patients with CKD.

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