

Cardiorenal Disease

The Pump and the Filter



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KEYWORDS

• Cardiorenal • Acute • Chronic • AKI • CHF

KEY POINTS

- There are 5 different types of cardiorenal disease, with the disease being a result of either an acute or cardiac event.
- One organ, either the heart or the kidney, is affected as a reaction to a pathologic disruption in the other organ.
- The diagnosis and treatment of cardiorenal disease depends on the cause of the initial insult.

Mrs XX is a 61-year-old woman with a history of an ischemic cardiomyopathy with a known ejection fraction of 35% to 40% as well as severe aortic stenosis, moderate mitral regurgitation, pulmonary hypertension, biventricular implantable cardioverter-defibrillator, right nephrectomy for a renal cell cancer, and severe peripheral vascular disease who presented to the hospital with marked dyspnea on exertion, orthopnea, and pedal edema and was found to have an increase in her serum creatinine.

Her baseline creatinine was 1.2 mg/dL. It had increased to 1.8 mg/dL before admission. It was noted to be 2.4 mg/dL on presentation to the emergency department. Her furosemide had been put on hold when her creatinine was first noted to be increasing from her baseline. Her weight was 179 lb on presentation, and a chest radiograph revealed pulmonary edema. She was admitted for diuresis. On discharge, her weight decreased to 149 lb. She was also started on lisinopril and maintained on furosemide with a stable creatinine of 1.5 mg/dL.

DEFINITION

Cardiorenal syndrome (CRS) refers to a whole host of insults that alter the function of either the kidney or the heart, thereby physiologically altering the balance of the baseline kidney-heart relationship. These insults may be acute or chronic. They may

Disclosure: The author has nothing to disclose.

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Physician Assist Clin 1 (2016) 115–125

<http://dx.doi.org/10.1016/j.cpha.2015.09.002>

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originate within the kidney or the heart. But, together, these insults alter the ability of either organ to maintain homeostasis.

Given that there exist many manners by which an alteration in the kidney/heart relationship may occur, Ronco and colleagues¹ defined 5 types of CRS based on acute or chronic injury to either the heart or the kidney (**Table 1**). Type 1 CRS refers to acute cardiac events leading to kidney disease. Type 2 refers to chronic cardiac events leading to kidney disease. Type 3 refers to acute kidney injury (AKI) leading to heart failure (HF). Type 4 refers to chronic kidney disease (CKD) leading to HF. Type 5 refers to systemic secondary causes that lead to both kidney and cardiac failures.

- CRS is a group of diseases that either acutely or chronically alter the cardiorenal homeostasis. CRS may occur from an independent systemic source that leads to both kidney and cardiac failure.

PREVALENCE

It is a well-appreciated observation that HF is common, with patients greater than 45 years old having a lifetime risk of HF of approximately 20%.² HF is the most common cause of death among patients with end-stage renal disease (ESRD). As CKD worsens, the percentage of patients with cardiovascular disease (CVD), including HF, increases as well as patient morbidity and mortality.³ In fact, patients with stage 3 CKD, with a glomerular filtration rate (GFR) of 30 to 60 mL/min, are more likely to die of CVD than to progress to ESRD.

It is estimated that kidney dysfunction is present in approximately 30% to 60% of patients with HF.⁴ Patients treated for acute or chronic HF often have changes in kidney function (in about 20% to 30% of patients).⁵

Thus, CVD is common; its role with acute or chronic changes in the GFR cannot be underestimated and neither can the role of kidney disease in the development of acute or chronic changes to the heart (**Box 1**).

A COMPLEX PHYSIOLOGY

Dr Arthur Guyton⁶ eloquently describes how the accepted pathophysiology of hypertension is much more than mere increased total peripheral resistance. His work with

	Clinical Example
Type 1: Acute cardiac events that lead to worsening of kidney disease	May be seen in patients with acute myocardial infarction who develop AKI
Type 2: Chronic cardiac events that lead to worsening of kidney disease	May be seen in patients with chronic systolic dysfunction who has increase in creatinine over time with no other explanations
Type 3: An acute change to heart function caused by AKI	May be seen in patients who develop AKI and develop an arrhythmia or an ischemic event as a result
Type 4: Development of worsening HF from CKD	May be seen in any patient with CKD who develops a cardiac consequence, such as cardiac hypertrophy or other cardiovascular event
Type 5: Systemic causes affecting both the kidney and the heart	May be seen in patients developing sepsis or vasculitis

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