

Advances in Practice

Management of Cardiovascular Disease in Patients With Impaired Renal Function

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Cardiovascular disease (CVD) is a common development of patients with chronic kidney disease (CKD), particularly with end-stage renal disease (ESRD). Complications that develop from CKD, as well as the underlying conditions such as hypertension and diabetes, can increase the risk for developing CVD. CVD is one of the most serious complications of advanced kidney disease, and is the leading cause of death for ESRD patients (1). There is growing concern that CKD patients receive inadequate preventative care for CVD, even though most health care professionals are well-aware of the heightened risk for development of this disease. Patients who present with mild renal

insufficiency or early stages of CKD should also be targeted for CVD prevention before any cardiac symptoms develop. This can help to prevent unnecessary premature cardiac complications.

Table 1 highlights the pathogenesis of CVD in CKD as adapted from Charles R. Nolan, who is from the University of Texas Health Sciences Center (2). This table demonstrates the multiple risk factors that can be involved in the development of CVD. The prevalence of cardiac risk factors increase with the stage of kidney dysfunction (3). In 2007, one-year mortality rates after a patient had an acute myocardial infarction (MI) was 27% in those without CKD, and 46% in those with Stage 3–5 CKD (4). Herzog et al discovered a sobering prognosis for patients with ESRD on long-term dialysis after MI; only 41% survived for one year after, and 27% for two years (5).

The cost for treatment of cardiac and/or renal disease alone can be devastating to many patients. Among Medicare patients, per person per month costs in 2007 after cardiac arrest were \$6,200 for non-CKD patients, and rose to \$11,500 for those with Stage 3–5 CKD (4). If none of the typical signs or symptoms of CVD are present during the initial routine cares of CKD, cardiac care measures may not be emphasized with the patient. The primary cause of death in kidney failure is CVD, and dietitians should take advantage of their important role in teaching cardiac nutrition guidelines at an early stage of the disease process (6,7).

Hyperlipidemia and CKD

The most common lipid abnormality in patients with kidney disease is an elevation of serum triglycerides, with

Table 1
Pathogenesis of CVD in CKD

Traditional Cardiac Risk Factors	Leads to....	Kidney-disease Related Risk Factors
Dyslipidemia →	Atherosclerosis ↕ CV Calcification	← Increased PTH
Age →		← Dialysis Duration
Hypertension →		← Oxidative Stress
Diabetes (hyperinsulinemia) →		← Impaired Renal Function
Genetic Predisposition →		← Endothelial Dysfunction
Smoking →		← Chronic Inflammation
Increased homocysteine →		← Hyperphosphatemia
		← Exogenous vitamin D

This table is adapted from a figure drawn by Charles R. Nolan (2) of the pathogenesis of cardiovascular disease (CVD) in chronic kidney disease. A plethora of factors may be involved in the pathogenesis of CVD in patients with ESRD, including traditional cardiac risk factors (white column) and kidney disease-related risk factors (gray column).

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coexistent elevations of very low-density lipoprotein (VLDL) and intermediate-density lipoprotein levels. Total cholesterol may be normal, decreased, or slightly elevated; whereas high-density lipoprotein (HDL) levels are often low. Low density lipoprotein (LDL) levels can be unchanged, mildly elevated, or even low (8). Men with chronic renal failure on hemodialysis have shown significantly higher levels of serum triglycerides, VLDL, and lower levels of LDL and HDL than controls (9). Following a renal transplantation, triglyceride levels may decrease and cholesterol often increases (7).

A wide array of mechanisms contribute to the lipid abnormalities in patients with kidney disease. The predominant metabolic abnormality is impaired catabolism and clearance of lipoproteins of hepatic and intestinal origin. This is related to decreased activities of lipoprotein lipase, lecithin-cholesterol acyltransferase, and hepatic triglyceride lipase (9,11). A lipoprotein lipase deficiency can lead to hypertriglyceridemia, which is the most prominent lipid abnormality in kidney failure. Due to this fact, education on prevention of or treatment for hypertriglyceridemia, along with the general cardiac and renal diet guidelines appears to be a logical intervention for renal dietitians.

According to the National Kidney Foundation, Nutrition and Early Kidney Disease Diet Guidelines, the nutrients that should be monitored in the diet for CKD stages 1-4 include protein, sodium, phosphorus, calcium, potassium, and fluid (12). Diabetes is also discussed in this booklet, but nothing is mentioned on heart disease. This education piece states, "If you are not getting enough calories from your diet, you may need to eat extra sweets like sugar, jam, jelly, hard candy, honey and syrup." However, the American Heart Association (AHA) recommends to "cut back on beverages and foods with added sugars to help fight cardiovascular disease," (13). Traditional renal diet guidelines do not include recommendations for cardiac health, and usually focus on the nutrients necessary for appropriate kidney function. It is essential to combine these recommendations and emphasize them from the initial consultation for signs of kidney disease. Therefore, when planning diets of renal impaired patients, it is important to consider nutrition-related CVD risk factors for the sake of quality of life and survival.

Strategies for Improving CVD Risk in Patients with Renal Impairment.

In May of 2001, the National Heart, Lung, and Blood Association's National Cholesterol Education Program (NCEP) released new guidelines for cholesterol management. The AHA issued a statement in 2003 that recommended patients with CKD be considered a "highest risk group" for subsequent CVD events (8).

The AHA has now been incorporating the new NCEP guidelines into its materials on dietary and lifestyle changes for people with elevated cholesterol. The Third Report of the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) recommends that therapy for elevated cholesterol begin with more intensive life-habit intervention to lower cholesterol and reduce the risk for developing heart disease and having a heart attack.

This approach is referred to as the "Therapeutic Lifestyle Changes (TLC)" diet, and the AHA has adopted this for people at high risk for, or who already have known CVD (13). Refer to Table 2 for the essential components of the TLC diet.

Table 2
TLC Diet in ATP III

Nutrient	Recommended intake as percent total calories
Total Fat	25-35%
Saturated Fat	Less than 7%
Polyunsaturated Fat	Up to 10%
Monounsaturated Fat	Up to 20%
Carbohydrate	50-60% of total calories
Protein	Approximately 15%
Cholesterol	Less than 200 mg per day
Total Calories	Balance energy intake and expenditure to maintain desirable body weight and prevent weight gain

The 25–35% fat recommendation allows for increased intake of unsaturated fat in place of carbohydrates in people with the metabolic syndrome or diabetes. Carbohydrate should come mainly from foods rich in complex carbohydrates, including whole grains, fruits and vegetables. Daily energy expenditure should include at least moderate physical activity (contributing to about 200 calories per day). Other options include adding 10–25 grams of soluble fiber; as well as two grams per day of plant-derived sterols or stanols. Soy protein may be used as a replacement for some animal products. These guidelines should be incorporated into renal diet handouts and education pieces for patients, and emphasized by dietitians during consultations. This can help to target both kidney and heart disease together, and maximize nutritional benefits.

Summary

The prognosis of patients with ESRD is poor, due to many pathophysiological factors. Under-diagnosis and/or inadequate treatment of underlying CVD in these medically complex patients

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are two areas that merit further study in this patient population. An increasing amount of literature suggests that timely diagnosis and treatment of CKD can delay disease progression and may decrease adverse cardiovascular outcomes. The Kidney Disease Outcomes Quality Initiative Guidelines suggest that the work-up should include at least a baseline EKG and an echocardiogram (14). Detection of risk factors for CVD (both traditional and kidney disease related) in the early stages of renal impairment may be necessary to have a significant impact on outcome.

There have been few controlled trials to demonstrate the efficacy of cardiac diet emphasis in CKD; therefore, the made recommendations are based on extrapolation from evidence on the efficacy of cardiac therapy in the general population. Further research into the effectiveness of early cardiac prevention measures in CKD is warranted. Dietitians should attempt to incorporate the TLC diet guidelines into their renal educational materials and emphasize their importance in the beginning stages of renal impairment to help prolong the lives of their patients. ♦

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