

Advanced kidney disease: What the nonnephrology NP needs to know

Abstract: *Nonnephrology NPs often encounter patients with advanced chronic kidney disease. As patients transition to nephrology care, NPs need to communicate with them about their disease status and treatment. This article describes the treatment approach in patients with advanced kidney disease including medical management, hemodialysis, peritoneal dialysis, and transplantation.*

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More than 37 million adults in the US have chronic kidney disease (CKD), an overall prevalence of about 15%.^{1,2} CKD is defined as the presence of structural and/or functional abnormalities of the kidneys for 3 months or greater.³ These structural and/or functional abnormalities include GFR <60 mL/min/1.73 m², albuminuria (albumin-to-creatinine ratio [ACR] ≥30 mg/g), casts on sediment analysis, autosomal dominant polycystic kidney disease, or kidney biopsy abnormalities.³ The evaluation of kidney disease prognosis is based on values of both estimated glomerular filtration rate (eGFR) and level of albuminuria.³ Importantly, advancing CKD is associated with several disorders (such as anemia and bone and mineral disorders) and major dire outcomes including loss of kidney function, development of cardiovascular disease, and death. Early prevention and intervention approaches initiated by nonnephrology NPs would help delay the progression of CKD and its consequences.

As patients progress to stage 4 (eGFR of 15-29 mL/min/1.73 m²) and stage 5 CKD (eGFR <15 mL/min/1.73 m²), namely advanced kidney disease, NPs have a pivotal role in facilitating the care transition process. Specifically, patients with stage 5 CKD would be categorized as having end-stage kidney disease (ESKD), requiring kidney replacement therapy; some patients may opt for conservative measures to maintain quality of life. Patients are referred to nephrology practices for treatment of kidney failure with one of

the four main therapeutic measures: hemodialysis, peritoneal dialysis, kidney transplantation, or conservative management. Thus, kidney failure is a life-changing diagnosis requiring decision-making and patient preparation on transitions of care. Nonnephrology NPs support patients by managing primary care issues and facilitating discussions about CKD and treatment options; these conversations are more effective earlier on in the process. In this article, we provide a general overview of the basics of dialysis (hemodialysis and peritoneal dialysis), transplantation, and medical management as a guide for NPs practicing with adult and geriatric patients outside the realm of nephrology.

■ When to refer to nephrology care

Specialized nephrology care could be considered for individuals with stage 3 CKD (eGFR of 30-59 mL/min/1.73 m²) to attempt to slow progression.⁴ However, when a patient progresses to stage 4 CKD, transition to kidney replacement therapy or conservative management is usually inevitable and a patient should be prepared for impending kidney replacement needs.³⁻⁶ In general, the 30-20-10 rule should be followed: At an eGFR of 30 mL/min/1.73 m², patient should be referred to specialized nephrology care; at eGFR of 20 mL/min/1.73 m², patient should undergo placement of an arteriovenous fistula/arteriovenous graft/peritoneal dialysis catheter; and finally, a patient with an eGFR of 10 mL/min/1.73 m² should make a

Keywords: chronic kidney disease (CKD), dialysis, disease management, end-stage kidney disease (ESKD), estimated glomerular filtration rate (eGFR), kidney failure, kidney replacement therapy, nephrology

decision on kidney replacement therapy and proceed with the therapy of choice.⁴ One study showed that early referral to nephrology providers 12 months prior to hemodialysis initiation was associated with overall reduced mortality risk in patients over a median follow-up of 60 months.⁷ Additionally, in a study of individuals 70 years of age and older, early referral (at longer than 3 months from ESKD diagnosis) contributed to improved 90-day survival.⁸

Eligibility for referral also includes other circumstances such as persistent significant albuminuria (300 mg/g or higher ACR), CKD and refractory hypertension (with 4 antihypertensive medications or more), derangements in serum potassium, and other factors.³

■ What to consider when referring

When considering referral to nephrology for a patient with advanced CKD (CKD stage 4 or 5), the nonnephrology NP needs to consider several management routes. The patient should be educated on the basics of both dialysis and conservative management (diuretics, dietary and fluid restrictions, medications for electrolyte abnormalities, and BP management). Without this discussion, many patients will be referred to nephrology without a basic plan or understanding of various management strategies and may feel dialysis is the only option. Nephrology and nonnephrology NPs should discuss both dialysis and con-

management, and their role in promoting patient satisfaction with care, adherence to therapy, and improved outcomes.

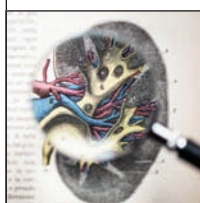
■ Strategies to prevent progression of CKD

NPs should stress the importance of adhering to nephrology provider visits, lab tests, and medications. In preserving kidney function and preventing kidney damage, treatment is directed at addressing the cause of CKD and managing reversible conditions. Importantly, several factors contributing to CKD are addressed.

BP management. Since the control of BP is essential for both slowing down CKD progression and prevention of cardiovascular events and mortality, mainstream therapy involves antihypertensive use.^{9,10} The BP target for adults with hypertension and CKD is less than 130/80 mm Hg, as per the American College of Cardiology/American Heart Association (ACC/AHA).¹¹ However, one should carefully consider the unique nature of the geriatric population and tailor a goal to ensure CKD risk reduction while avoiding complications such as acute kidney injury (AKI) and orthostatic hypotension.

Management strategies for patients with CKD and hypertension should include both lifestyle changes (targeting body mass index of 20-25 kg/m², limiting salt intake to <2 g/24 hours, exercising at least 30 minutes five times per week, stopping smoking, and limiting alcohol intake to two standard drinks daily for men and one for women), and pharmacologic measures including angiotensin-converting enzyme inhibitors (ACEi) or angiotensin receptor blockers (ARBs) as first-line kidney-protective agents.^{3,12} After initiating or titrating doses of ACEi/ARBs, clinicians should monitor BP, serum creatinine, and serum potassium within 1 week.³

Blood glucose control. Patients with diabetes mellitus need to be well managed to reduce risks of progression of both cardiovascular and kidney disease. Clinicians should monitor hemoglobin A1c anywhere from two to four times yearly depending on antihyperglycemic treatment adjustments. A hemoglobin A1c of about 7% is favorable;³ glycemic target would be individualized between <6.5% and <8.0% depending on patient factors such as risk for hypoglycemia or presence of other comorbidities. In addition to



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servative management options. Furthermore, at the time of referral, a nonnephrology NP may need to consider patient access to nephrology providers. If a patient resides in an underserved or unsaturated community, new patient visits for nephrology consultation may be unavailable for weeks to months. In such instances, much of the management of advanced CKD will need to be done by the nonnephrology NP. However, prescribing and monitoring should be appropriately allocated between nephrology and nonnephrology provider to prevent duplication or omission of treatments and prescriptions. The above-mentioned factors highlight the importance of nonnephrology NPs' knowledge of kidney disease and its

metformin, insulin, and other commonly used hypoglycemic agents, the use of sodium-glucose cotransporter-2 (SGLT-2) inhibitors in those with severe albuminuria (ACR > 300 mg/g) is encouraged. SGLT-2 inhibitors lower cardiovascular risk in patients with diabetes and CKD; additionally, canagliflozin, an SGLT-2 inhibitor, has been shown to lower the risk of decline of kidney function and mortality from renal or cardiovascular disease.^{13,14} These medications should be dosed appropriately based on the patient's eGFR. Metformin and SGLT-2 inhibitors should not be used in patients with eGFR <30 mL/min/1.73 m².^{3,15}

As per the Kidney Disease: Improving Global Outcomes (KDIGO) 2012 clinical practice guideline, ACEi or ARB medications should be considered in patients with diabetes and albuminuria even in the absence of elevated BP.³ It is advisable to continue ACEi/ARBs even when serum creatinine increases, if the increase is no more than 30% higher than the patient's baseline serum creatinine.¹⁶ One common adverse reaction of ACEi/ARB medications is hyperkalemia; reducing potassium intake or using potassium-lowering agents could be considered instead of abruptly discontinuing the ACEi/ARB medication, though further research is needed to determine cardiovascular and renal outcomes.¹² The clinician should reduce the dose of ACEi/ARB if the patient is found to have symptomatic hypotension, uncontrolled hyperkalemia, or while preparing for imminent kidney replacement therapy.

Avoidance of nephrotoxins and appropriate dosing of medications. With worsening CKD, several drugs should be administered in lower doses, and others used with caution. Proper drug dosing is important for effective treatment and avoidance of adverse reactions. Drug dosage adjustments may be found on drug labeling approved by the FDA. We highlight specific drug classes below, with examples.

Consideration is to be given to drugs with a narrow therapeutic index (for example, lithium and digoxin) to avoid toxicity. Such drugs require dose reductions according to kidney function and therapeutic level monitoring.¹⁷ For antibiotics, dose adjustment is made according to alterations in pharmacokinetics (such as changes in protein binding, kidney clearance, volume of distribution), and based on pharmacodynamic considerations (amount and frequency of drug as pertinent to concentration-dependent and time-dependent antibiotics).¹⁸ For example, maintenance doses of penicillins and

cephalosporins may need to be reduced in certain patients; in general, dosing intervals may need to be lengthened and dose reductions need to be made when prescribing fluoroquinolones, while nitrofurantoin is mostly avoided in advanced CKD.^{18,19} With antihyperglycemic agents like metformin (a biguanide), sulfonylureas, dipeptidyl peptidase-4 inhibitors, and glucagon-like peptide-1 agonists, dose adjustments are required in CKD.¹⁹ Glyburide (a second-generation sulfonylurea), exhibiting mostly kidney clearance, is avoided due to its increased risk of hypoglycemia. Finally, as 50% of insulin is excreted by the kidneys, dose reductions are needed. Additionally, dose adjustments might be needed for antiplatelets and anticoagulants as per manufacturer recommendations to avoid the adverse reactions of bleeding.

In patients on hemodialysis, drug clearance is an important consideration for drug dosing. For example, drugs that have low molecular weights or are water-soluble are more prone to be cleared by hemodialysis. For these types of drugs, additional dosing may be required. Other factors like dialyzer membrane pore size and membrane composition, dialysate flow rates, and blood flow rate also affect drug clearance. With drug clearance increased in dialysis using new high-flux filters, drugs like certain antibiotics or antihypertensives may need to be administered after each dialysis session.¹⁸ Additional strategies can include choice of a drug with a longer half-life, such as the ACEi lisinopril, administered three times a week after dialysis.

Finally, certain medications such as nonsteroidal anti-inflammatory drugs and aminoglycoside antibiotics must be avoided in advanced CKD because of their potential for nephrotoxicity.

■ General management of disorders associated with advanced CKD

There are often several coexisting disorders requiring treatment alongside advanced CKD and kidney replacement therapy needs, as follows. Typically, it will be the nephrology provider managing these comorbidities, but open discussion between the nephrology provider and nonnephrology NP to discuss delineation of prescribing and monitoring is appropriate. This will help avoid risk of duplicate prescribing, labs, and limit the chance of omitting prescribed therapies.

Anemias. The underpinnings of anemia are often multifactorial. Major factors noted for anemia in CKD

and patients on dialysis include insufficient production of erythropoietin, iron deficiency, acute and chronic inflammatory disorders, elevated hepcidin levels, severe hyperparathyroidism, aluminum toxicity, folate or vitamin B12 deficiency, and decreased survival time of red blood cells.^{4,20} The most common forms of anemia in advanced CKD and ESKD are anemia of chronic disease and iron deficiency anemia. Initial anemia workup would include an evaluation of CBC, absolute reticulocyte count, serum ferritin, iron studies, serum vitamin B12, and serum folate levels.^{3,4,19} Oral iron therapy should be initiated if transferrin saturation is less than or equal to 30% and ferritin is less than or equal to 500 ng/mL.⁴ If iron, vitamin B12, and folate replacements are insufficient to correct anemia, erythropoiesis-stimulating agents (ESAs) can be initiated and dosed based on CKD status. ESAs should be titrated to maintain hemoglobin at 9.0-11.5 g/dL.^{3,4}

Bone and mineral disorders. Frequently, bone and mineral abnormalities are found in patients on kidney replacement therapies. These findings are usually a combination of hyperphosphatemia, secondary hyperparathyroidism, and hypocalcemia. With advanced CKD, the decreased clearance of phosphorus results in hyperphosphatemia leading to decreased production of 1,25-(OH)₂D₃ (calcitriol), decreased serum calcium, and increased serum intact parathyroid hormone (iPTH).^{4,21} Overall management is aimed at reducing serum phosphorus, normalizing serum calcium, and normalizing iPTH levels to prevent complications of bones and soft tissues. Management may include vitamin D replacements (ergocalciferol, cholecalciferol, calcitriol, and the like), dietary phosphate restrictions and phosphate binders taken with meals (calcium acetate, sevelamer, and the like), and the usage of calcimimetics (cinacalcet).^{4,21} Avoidance of hypercalcemia is important in order to prevent vascular calcifications.²¹ Currently, optimal levels of iPTH in patients not on dialysis is unknown. Appropriate medication management should be conducted based on lab values. If left unchecked, osteomalacia, adynamic bone disease, high-turnover bone disease, pathologic fractures, calcium deposition in soft tissues, and calciphylaxis can occur.^{4,5}

Blood pressure abnormalities. Both hypertension and hypotension can influence the overall efficacy of kidney replacement therapies and the management of patients on such therapy.²² Nonnephrology NPs

should discuss BP management with the nephrology and cardiology providers if significant comorbidities exist. Hypertension should be managed based on coexisting factors such as age, diabetes, and the ACC/AHA guidelines mentioned above. Moreover, nephrology providers are keen on intradialytic BP assessment. Hypotension is to be avoided during dialysis and hypertensive episodes need to be controlled to avoid complications.²³

Fluid volume status. Fluid management of patients not on dialysis should include both fluid restrictions and diuretics. Regular weight assessment will help detect longitudinal changes in fluid volume status with the progression of CKD. Diuretics should be chosen carefully based on eGFR; thiazides should be used with eGFR greater than 30 mL/min/1.73 m² and loop diuretics should be used in eGFR less than 30 mL/min/1.73 m². If patients continue to have volume overload despite fluid restriction and monotherapy with loop or thiazide diuretics, NPs could consider combining therapy with both loop diuretics and thiazides; this requires careful monitoring for hypotension, AKI, hypokalemia, and hypomagnesemia.⁴ For hypokalemia, NPs could consider the addition of potassium-sparing diuretics if additional fluid removal is needed.

A major goal of kidney replacement therapies, in addition to removal of excess solutes and toxins like nitrogenous waste, is achieving appropriate fluid volume status. Factors determining appropriateness of treatment include urine output (oliguria and anuria are common), estimated target weight, and weights before and after dialysis treatments. Data on patients' weights allow nephrology providers to evaluate current fluid volume status and determine the amount of fluid to be removed in upcoming dialysis treatments (ultrafiltration).^{4,5,22} If a patient has significant residual kidney function, diuretics may be used to maintain the residual kidney function and improve fluid volume status.

Other common electrolyte abnormalities. In addition to derangements in serum phosphorus and calcium levels, other electrolyte abnormalities may be present. Hyperkalemia and hyponatremia are common in patients requiring kidney replacement therapies. Hyperkalemia is usually secondary to increased intake of potassium-rich foods or potassium shift from intracellular to extracellular fluid.^{4,5} Patients can be counseled on a low potassium diet and be prescribed

potassium-reducing medications by the nephrology provider if diet restriction is insufficient.

Hyponatremia, usually mild, is found in many patients on dialysis due to fluid volume overload, with greater emphasis in those with a relative deficiency in sodium.^{4,5,24} Often fluid restrictions are appropriate for patients with hyponatremia. Hyponatremia can also occur due to thiazide-type diuretic usage. If thiazide-type diuretics are the probable source of hyponatremia, changing diuretic classes could be considered. Sodium chloride tablets can be used,⁴ but these often promote fluid retention. Both sodium and potassium imbalances can be treated with conservative management (such as dietary restrictions) or alterations in dialysis (dialysate electrolyte concentration) if the patient is on dialysis.

Nutritional issues. Hypoalbuminemia is a common nutritional issue in patients who require kidney replacement therapies.^{4,25} Achieving appropriate protein intake in this population is necessary, as proteins like albumin exhibit oncotic pressure. Oncotic pressure is necessary to hold fluid in the intravascular component, avoiding displacement into tissues. Kidney replacement therapies, such as dialysis, target fluids in the intravascular compartment of the body and are ineffective at removing fluid in interstitial tissues. Supplementing protein is appropriate but serum blood urea nitrogen (BUN) needs to be considered, as the latter is the end-product of protein degradation.⁴ Furthermore, patients on dialysis often face malnutrition due to factors such as depression and anorexia. Food and fluid restrictions, including low phosphate and low potassium diets, can also contribute to those factors.^{4,25,26}

Additional management considerations. In cardiovascular disease prevention, low to moderate doses of statins can be used in patients with CKD starting at 50 years of age.^{13,27} Statin initiation is not recommended for patients on kidney replacement therapies as there is no clear evidence of cardiovascular or survival benefit.²⁷ Pruritus is a common concern in patients with CKD, and first-line treatment typically includes skin hydration with topical products.²⁸

■ Conservative management in advanced CKD

Kidney replacement therapies are not always the best management option for all patients with ESKD. Conservative management is focused on improving quality of life while dialysis is usually

focused on balancing both quality and quantity of life.²⁹ Conservative management usually entails diuretic use and fluid restrictions for fluid volume status optimization, dietary restrictions such as potassium and phosphates, potassium binders such as sodium polystyrene sulfonate or patiomer, and BP management. NPs should focus on promoting patient values and patient preferences, sharing decision-making, and considering symptom burden when discussing treatment options including dialysis and conservative management with patients with advanced CKD.^{29,30}

Currently there are limited data on outcomes of conservative management in advanced CKD.^{31,32} Even with the scarcity of comprehensive outcome data,^{31,32} nephrologists and primary care providers responding to a survey reported being comfortable discussing conservative management.³¹ In a retrospective single-center study in the Netherlands, a subgroup analysis by age revealed that there was no difference in survival in patients 80 years or older based on management approach (kidney replacement therapy or conservative treatment).³³ A prospective, multicenter study in Australia showed that 18% of patients with CKD remaining on conservative management (median age of 80 years; interquartile range [IQR]: 75-85 years) survived at the end of a 3-year study period.²⁹ Furthermore, in a recent Canadian study of patients with ESKD (median age of 78.5 years; IQR: 72.4-84.7 years), Tam-Tham and colleagues found that patients receiving maintenance dialysis spent more time in the hospital setting and were more likely to be admitted into CCUs than patients receiving nondialysis care.³⁴ Of note, a systematic review highlighted a few studies where older patients with more functional impairments tended to undergo conservative management instead of dialysis, indicating that older patients with functional impairment seem to choose conservative treatment.³⁰ Older patients with increased functional impairment could be considered for conservative management instead of dialysis. Patients currently on dialysis should also be given the opportunity to withdraw from care to focus on quality of life.

■ Kidney replacement therapy

With the progression to ESKD, patients may undergo hemodialysis, peritoneal dialysis, or kidney transplantation, as discussed in the following section. Typical indications for kidney replacement therapy

initiation or adjustment include volume overload that is insufficiently corrected with diuretics and fluid restriction, hyperkalemia uncontrolled with diet and pharmacologic management, acidosis, uremic syndrome, and some poisonings like methanol or ethylene glycol.³⁻⁵ If urgent dialysis is indicated, nephrology providers choose hemodialysis due to quick access and results relative to peritoneal dialysis.²³

Dialysis overview. There are two major forms of dialysis used in the US: hemodialysis and peritoneal dialysis. Hemodialysis involves filtering a patient's blood through a dialyzer (filtration membrane) against a gradient of dialysate (dialysis fluid) to complete the principle functions of dialysis. The biochemical makeup of the dialysate includes varying amounts of sodium, potassium, bicarbonate, and calcium.^{4,35,36} This allows the nephrology provider to individualize dialysate for each patient to ensure proper electrolyte levels will be established following dialysis. Typical minimum goals and target goals, respectively, have been greater than 1.2 and 1.4 of Kt/V, and greater than 65% and 70% for urea reduction ratio (URR), which are both measurements of dialysis adequacy.^{5,37} As URR calculation may be error-prone, it is now advocated that nephrology practitioners resort to more precise methods.³⁸ Patients' weights are measured before hemodialysis and after, to determine appropriateness of fluid volume status.⁴ There are three major vascular access means for the standard outpatient undergoing hemodialysis: arteriovenous fistula (AVF), arteriovenous graft (AVG), and central venous catheter (CVC). The AVF is the gold standard of access,^{5,39} but it takes several months to mature and become amenable for use. Patients should be referred to nephrology and subsequently will likely be referred to a vascular surgeon for evaluation when eGFR drops to around 20 mL/min/1.73 m².³⁻⁵ Early placement of AVF/AVG during CKD stage 4 will allow time for the AVF/AVG to mature before dialysis treatments are needed.

Peritoneal dialysis is another major modality of kidney replacement therapies. This modality of kidney replacement is considered when patients have good support at home, in patients with good functional status, and in those who have significant residual kidney function.⁴ This type of dialysis utilizes the patient's own peritoneal membrane as the

dialyzing membrane after a catheter is placed in the peritoneal cavity.⁴ Glucose-based, icodextrin (starch-based), or amino-acid-based solutions in the dialysate may be used in varying concentrations to remove fluid (ultrafiltration).⁴ Monitoring for dialysis efficacy in peritoneal dialysis is similar to monitoring in hemodialysis, with a few exceptions. Weekly Kt/V is drawn either with or without residual kidney function.^{5,40}

i) Common adverse reactions and outcomes in hemodialysis and peritoneal dialysis

Common adverse reactions of hemodialysis include pruritus, nausea, vomiting, hypotension, and cramping.²³ Each of the signs and symptoms typically occur during hemodialysis and can often be treated promptly with simple interventions. More serious adverse consequences of hemodialysis include vascular access hemorrhage, vascular access-induced ischemia or "steal" syndrome, and bacteremia.^{23,41}

The most common adverse reaction of peritoneal dialysis is infection of the catheter or peritoneal cavity. Peritonitis accounts for 15%-35% of hospital admissions for the patients on peritoneal dialysis.⁴ The most typical signs and symptoms of peritonitis are cloudy effluent (used dialysate) and abdominal pain.^{4,5,42} Other signs and symptoms are gastrointestinal upset, chills, and fever.^{4,42} Furthermore, infections of the peritoneal catheter and exit-site infections can occur with or without peritonitis.^{4,5,42} Other potential adverse reactions of peritoneal dialysis include hemo-peritoneum, hernias, abdominal wall leak, hydrothorax, pleural effusion, and sclerosing encapsulating peritonitis.^{4,5}

ii) The overall "dos and don'ts" for patients on dialysis for nonnephrology NPs

The following suggestions help ensure the safety of patients on kidney replacement therapies. It is recommended that nonnephrology NPs avoid supplementation of potassium, sodium, bicarbonate, or calcium in patients without consulting the nephrology provider as the elements may be adjusted in the dialysate. Nonnephrology NPs should frequently assess and encourage adherence with dialysis time and schedule, as well as adherence with diet and fluid restrictions. Dialysis access sites need to be frequently assessed to ensure viability and freedom from infection. Finally, nonnephrology NPs should consider rescheduling the administration of dialyzable medications.

■ Kidney transplantation


When a patient with kidney failure opts for kidney transplantation, obtaining a kidney becomes the challenge. It may take a long time before a suitable kidney (deceased or living donor) allocation is made to the patient through a transplant program. It is important to recognize that, even when patients do receive kidney transplants, 10-year all-cause graft failure remains at 51.6% for deceased-donor transplants and 34.2% for living-donor transplants.⁴³ Patients can be referred to the transplant center once their eGFR reaches 20-30 mL/min/1.73 m². Each center has criteria a patient must meet to be accepted for transplant. Proper care of a kidney transplant should be a collaborative effort between the patient, primary care provider, nephrology care provider, and the transplant team.

■ Psychosocial factors

It is common for patients requiring kidney replacement therapy to suffer from depression and anxiety.⁴ Those exhibiting signs or symptoms of severe depression or anxiety should be referred to counseling. Patients also face social issues such as the need for social support, worries about employment and finances, and challenges with transportation and handling of equipment.⁴⁴ Nephrology clinics often involve social workers to guide patients on resources to aid in problem resolution. Nonnephrology NPs can also serve as a support mechanism to discuss depression, fears, and general concerns about dialysis. Peer support groups can help patients feel connected, encouraged, and empowered in facing various challenges. Finally, as patients undergoing kidney transplantation may be at risk for psychiatric or psychological disorders, pre- and posttransplant psychosocial assessments can help devise interventions to avoid poor outcomes, such as organ rejection due to non-adherence to therapy.⁴⁵

■ Conclusions

Advanced kidney disease places several challenges on patients. NPs outside of nephrology are pivotal to the smooth transition of patients to nephrology care and in the comanagement of conditions associated with advanced CKD. Knowledge of issues pertinent to advanced CKD helps nonnephrology NPs better prepare patients for upcoming experiences with kidney replacement therapy or conservative management.

Nonnephrology NPs must consider both lifestyle and pharmacologic therapies to achieve optimal patient outcomes. It is important to acknowledge that patients may also experience psychosocial issues including fear of new treatment modality, depression, financial concerns, inadequate social support, issues with transportation and handling of equipment, among others. Thus, multidisciplinary care planning is crucial for the provision of holistic care. 

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