

Long-Term Medical Management for Patients with Kidney Transplants

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Kidney transplantation improves the quality of life in nearly all patients who undergo the procedure, freeing them from the constraints of maintenance renal replacement therapy. The surgery liberalizes patients' fluid intake, allows them to consume a normal diet, and often reestablishes sexual function in both sexes. Moreover, it can restore fertility in women. In elderly patients and those with diabetes mellitus, recent evidence suggests that not only is quality of life improved after kidney transplantation, but length of life is also prolonged.¹ With modern immunosuppression techniques, most patients can anticipate many years without a need for dialysis once they receive a kidney transplant as treatment for their renal disease.

The care of patients who have undergone kidney transplantation generally comprises 2 distinct time periods. During the immediate posttransplantation period, the patient is often seen multiple times every week and may have blood drawn even more frequently. It is a period of very intensive care that requires a full-time staff of dedicated nurses and physicians trained in transplantation medicine. Depending on the number of posttransplantation complications, this period usually lasts from 6 months to 1 year. This article will largely deal with the second time period, or the time from when acute posttransplantation issues are resolved onward. During this period, the general internist has an active role, in conjunction with the transplantation nephrologist, in the comanagement of patients with kidney transplants.

EPIDEMIOLOGY

Data from the United Network for Organ Sharing Annual Report demonstrates that the long-term survival of a renal allograft is greater if it comes from a living donor as opposed to a cadaver donor. The number of rejection episodes also affects long-term graft survival.²⁻⁴ There has been debate recently about whether or not recent advances in 1-year graft survival have led to an improvement in long-term survival of the allograft.^{5,6} The crux of this argument centers on whether or not the death of patients with still functioning allo-

grafts is considered graft failure.⁷ If all patients with renal allografts are considered, there is little improvement in graft survival over the past decade; the half-life has remained approximately 13 years when living and cadaveric donor transplants are considered together. However, if the data are censored to eliminate deaths of kidney transplant patients with still functioning allografts, the half-life improves dramatically⁶ (Figure 1). Nevertheless, regardless of which argument is correct, kidney transplantation is an effective long-term therapy.

FOLLOW-UP OF KIDNEY TRANSPLANT PATIENTS

Generally speaking, the risk of rejection is highest during the first 3 months after transplantation, declines during the next 3 months, and becomes a rare event after 6 to 12 months. Once a patient has passed the initial posttransplantation period, the interval between office visits is generally 2 to 4 months.⁸ This interval ensures that elevated serum creatinine levels do not go undetected for an excessive period of time. In addition to physical examinations performed during these office visits to address any specific complaints, blood pressure should be measured; if there is any reason to suspect volume depletion, a proper orthostatic blood pressure measurement should be performed.

Because kidney transplant patients are at significantly increased risk for squamous cell skin cancer (compared to the general population) as a result of their use of immunosuppressive medications, their skin should be routinely examined and patients referred to a dermatology service if there are any suspicious lesions.⁹ Patients who receive a calcineurin inhibitor (eg, cyclosporine, tacrolimus) should have their gums routinely examined for signs of gingival hyperplasia; although administration of azithromycin, a macrolide antibiotic that does not affect calcineurin inhibitor levels, can be an effective treatment for this adverse effect,

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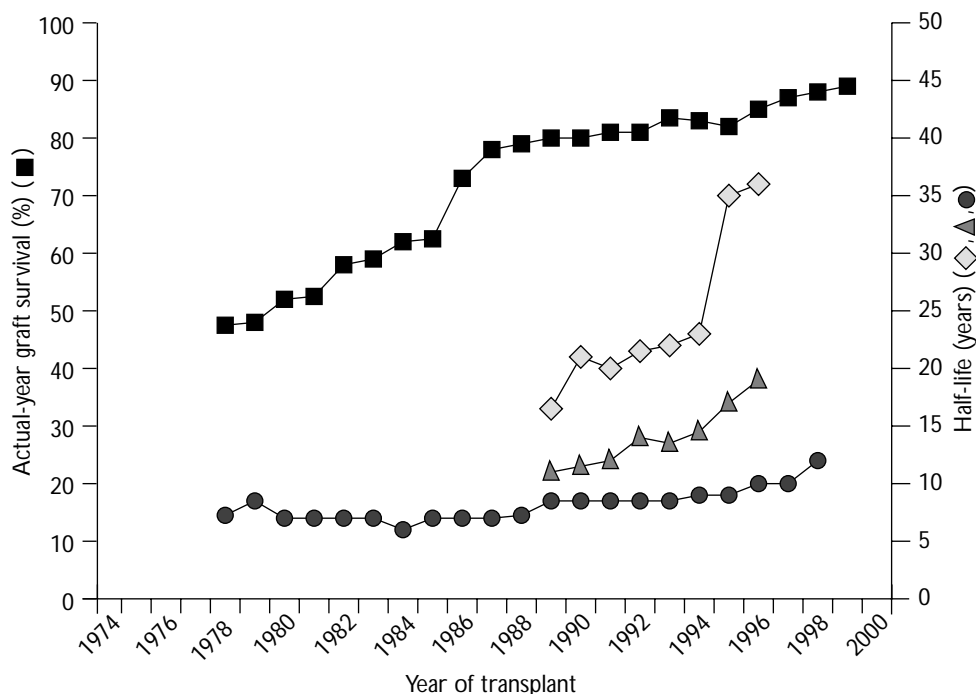


Figure 1. Chronic allograft dysfunction. (Data from Hariharan et al⁶ and from the United Network for Organ Sharing Web site [http://www.UNOS.org].) ■ = 1-year renal allograft survival; ◆ = projected half-life of renal allografts from living donors with censoring for deaths of patients; ▲ = projected half-life of renal allografts from cadavers with censoring for deaths of patients; ● = half-life of all renal allografts without censoring of death of patients.

the most useful intervention is to encourage good oral hygiene and refer to a dentist for further evaluation. Additionally, the abdomen should be examined for any signs of tenderness or fullness over the allograft, because these signs can indicate a collection of fluid around the kidney or rejection of the transplanted organ. The extremities should be examined for edema, and blood tests (eg, complete blood count; measurement of serum levels of sodium, potassium, chloride, bicarbonate, blood urea nitrogen, creatinine, calcium, phosphorus, glucose, drugs) should be ordered.

Any laboratory evidence of renal dysfunction that cannot be attributed to volume depletion should precipitate a prompt referral back to the transplantation nephrologist. Additionally, a urinalysis should be performed during each visit to assess patients for proteinuria, which can herald recurrent renal disease or the beginning of chronic allograft dysfunction. New onset proteinuria or a significant increase in baseline proteinuria is another reason for prompt referral back to the transplantation nephrologist for further evaluation. A culture need only be obtained if the patient has

symptoms consistent with a urinary tract infection or if a urine dipstick test is positive for leukocyte esterase.

As a result of the immunosuppressive medications used in kidney transplantation, there is an increased incidence of cervical and breast cancer in women who undergo the procedure. Additionally, immunosuppression can accelerate the progression of these cancers if they are not detected prior to transplantation. Because of these facts, it is recommended that women receive Papanicolaou smears every 6 months and screening mammograms yearly. Another issue involving female kidney transplant patients is unwanted hair growth. Some women who receive cyclosporine develop excess hair growth on their arms and faces; switching the medication of affected patients to tacrolimus can help reduce or eliminate this known adverse effect of cyclosporine.

DIFFERENTIAL DIAGNOSIS FOR PATIENTS WITH INCREASED SERUM CREATININE LEVELS

An increase in serum creatinine level during the first year after kidney transplantation is associated with a broad differential diagnosis (Table 1). Once noncompliance with medications has been ruled out during

history taking, a number of steps are appropriate. First, if the patient is taking cyclosporine or tacrolimus, the drug level in the blood must be checked. Currently, the standard is to measure whole blood cyclosporine or tacrolimus levels in a 12-hour trough sample. Target trough levels vary, depending on the local practice of individual transplantation centers, but in general a cyclosporine trough level of 100 to 150 µg/L and a tacrolimus trough level of 8 to 10 µg/L are desirable from 1 year posttransplantation onward. Calcineurin inhibitors cause vasoconstriction of the afferent arteriole. A drug level that is clearly in the toxic range or is elevated, compared to the patient's normal level, can cause an elevation in serum creatinine level.

The patient should be questioned next about recent viral illnesses, which can cause an elevated serum creatinine level through volume depletion resulting from any associated vomiting or diarrhea. Moreover, virally induced interstitial nephritis can cause the serum creatinine level to increase.

The urine should be examined both by a urine dipstick test and by microscopy. New onset proteinuria can herald the beginning of chronic allograft nephropathy, and new onset hematuria or proteinuria can indicate recurrent disease in the allograft.

Another cause of an increased serum creatinine level is a lymphocele. A lymphocele is a collection of lymph around the renal allograft that occurs because the lymphatic system draining the leg is disrupted at the time of transplantation in order to make space for the allograft. Although the occurrence of a new lymphocele would be rare 6 months after transplantation, an existing lymphocele might have enlarged and now be compressing the allograft. Because this problem can occur but is easily remedied, it should be excluded as a diagnosis. The patient should be examined for any new mass or fullness over the allograft. Other related physical examination findings include worsening edema in the leg on the side of the transplant. If there is a suspicion of a lymphocele, an ultrasound examination of the allograft can quickly eliminate it as a cause of the elevated serum creatinine level. The finding of a symptomatic lymphocele necessitates prompt referral back to the transplantation team.

If patients are taking hepatic hydroxymethylglutaryl-coenzyme A (HMG-CoA) reductase inhibitors, they should be questioned regarding symptoms and examined for signs of rhabdomyolysis; laboratory measurement of serum creatine kinase level should be obtained. It has been observed that much lower levels of serum creatine kinase can cause dysfunction in an allograft than are needed to cause dysfunction in native

Table 1. Differential Diagnosis in Kidney Transplant Patients Whose Serum Creatinine Level Is Increased

Potential Diagnosis*	Steps to Confirm/Exclude
Volume depletion	Ask about recent diarrheal illness, nausea and vomiting, reduced oral intake; obtain orthostatic blood pressure measurement; compare patient's weight with baseline values.
Calcineurin toxicity	Check whole blood trough levels of immunosuppressive drugs (eg, cyclosporine, tacrolimus).
Chronic allograft dysfunction	Examine urine to detect new onset (or increasing level) of proteinuria; consider performing a kidney biopsy.
Viral infection	Ask about recent viral syndromes; order a laboratory test of the blood to detect the presence of cytomegalovirus antigen.
Acute rejection	Ask about patient's medication compliance; perform a kidney biopsy.
Rhabdomyolysis	Perform a urine dipstick test to detect blood (without erythrocytes); obtain laboratory measurement of creatine kinase level.
Acute interstitial nephritis	Check urine for leukocytes (in the absence of a positive culture); review medications for possible causative drugs.

*Diagnoses arranged from most to least likely.

kidneys. The cause of this phenomenon is not precisely known but may be associated with more chronic exposure to the muscle breakdown products of myoglobin or hematin or to their interaction with calcineurin inhibitors.

BLOOD PRESSURE CONTROL

Most kidney transplant patients who receive calcineurin inhibitors will develop hypertension. This outcome may change as newer immunosuppressive agents (eg, rapamycin) enjoy greater use. However, until that eventuality occurs, controlling kidney transplant patients' hypertension will demand a large portion of the assigned internist's time. It is tempting to link poorly controlled hypertension to chronic allograft dysfunction. Although there are few data linking mild hypertension to worsening renal disease in patients with normally functioning kidneys, it has been clearly shown that uncontrolled hypertension hastens renal demise in patients with diseased native kidneys. Because

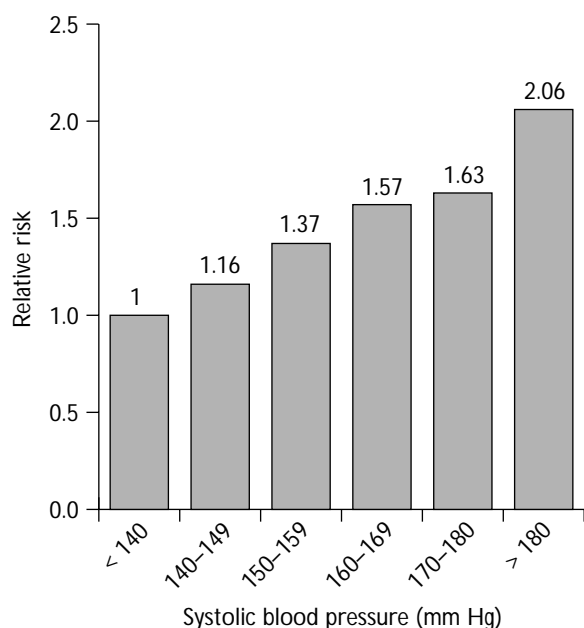


Figure 2. Role of hypertension in chronic allograft dysfunction. The graph depicts the increase in relative risk of loss of renal allograft function for each 10 mm Hg increase in systolic blood pressure. A relative risk of 1.0 is arbitrarily set for a systolic blood pressure of 140 mm Hg. (Adapted with permission from Opelz G, Wujciak T, Ritz E. Association of chronic kidney graft failure with recipient blood pressure. Collaborative Transplant Study. *Kidney Int* 1998;53:220.)

patients with well-functioning allografts have, at best, only 50% of normal renal function, it seems likely that the transplanted kidney would respond similarly to a diseased native kidney. However, the data currently used to support this view have been criticized, because the association between blood pressure and the relative risk of allograft dysfunction (**Figure 2**) does not take into account serum creatinine level.¹⁰ Yet, it is equally plausible that the elevated blood pressure is caused by the renal insufficiency.

These arguments notwithstanding, meticulous control of blood pressure is the rule when caring for patients with kidney transplants. In addition to the likelihood that such care will have the benefit of prolonging allograft survival, there is a known association between hypertension and the development of cerebrovascular and cardiovascular disease.¹¹ Because cerebrovascular and cardiovascular disease are collectively the leading cause of death in kidney transplant patients (**Figure 3**), an attempt should be made to lower the blood pressure as much as tolerated, without causing symptoms of orthostasis. Because a transplanted kidney is not innervated and, therefore, has

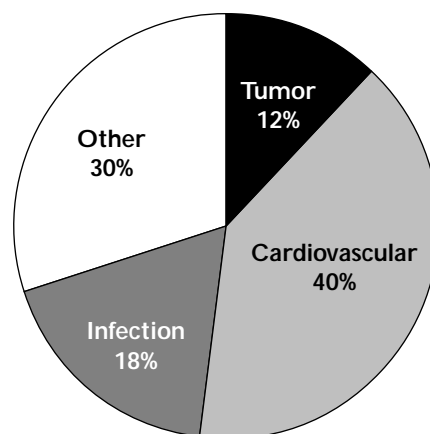


Figure 3. Causes of death in kidney transplant patients. (Adapted with permission from Danovitch GM, editor. Handbook of kidney transplantation. 3rd ed. Philadelphia: Lippincott Williams & Wilkins; 2001:184.)

less ability to autoregulate its blood flow, a general rule is not to lower blood pressure so significantly that systolic pressure falls below 120 mm Hg. With this caution in mind, a lower blood pressure may be tolerated without difficulty for any individual patient; the physician should exercise clinical judgment as to whether or not a medication should be withdrawn to allow the blood pressure to increase.

Renal allograft recipients with diabetes mellitus require special consideration. Patients with end-stage renal disease who have diabetes mellitus have significant loss of autonomic nervous system function, which leads to orthostatic hypotension.^{12,13} This loss carries over into the posttransplantation period and can be very debilitating. It is important to document a lying and standing blood pressure in all kidney transplant patients but particularly in patients with diabetes mellitus. If significant orthostatic decreases in blood pressure occur, only upright blood pressures are considered. This step necessitates acceptance of otherwise unacceptably high supine blood pressures.

There exists some preliminary evidence that use of the peripheral vasoconstrictor midodrine is effective in treating orthostatic hypotension caused by diabetic autonomic neuropathy. In 8 patients who underwent pancreas transplantation and developed symptomatic orthostasis, midodrine in doses ranging from 5 to 10 mg three times daily resulted in both measurable improvement in blood pressure and improvement in symptoms.¹⁴ The most frequent adverse effect was an asymptomatic increase in supine hypertension; there was no reported effect on kidney function.

In the treatment of hypertension, earlier generation calcium channel blockers (eg, diltiazem) should be avoided because of their effect on serum levels of calcineurin inhibitors. However, fourth-generation calcium channel blockers (eg, amlodipine, felodipine, isradipine) are both safe and effective. The α -/ β -adrenergic antagonist labetalol is a commonly used drug that is effective in controlling blood pressure and easy to titrate. Other medications commonly used include the central α -receptor blocker clonidine and the peripheral α -receptor blockers terazosin and prazosin.

LIPID CONTROL

Initial work in heart transplant patients suggested that the use of HMG-CoA reductase inhibitors could reduce the number of rejection episodes.^{15,16} This belief was bolstered by *in vitro* work with peripheral T cells from these patients that demonstrated reduced proliferation.¹⁷ Additionally, natural killer cells from these patients showed reduced cytotoxicity.¹⁸ An initial pilot study similarly indicated that the HMG-CoA reductase inhibitor pravastatin reduced the rate of rejection in kidney transplant patients.¹⁹

The possible flaw in the cited studies is that cyclosporine is a very lipophilic molecule. In these studies, whole blood cyclosporine levels were followed; it is possible that, despite equivalence of whole blood cyclosporine levels, the concentration of free drug is higher in patients with lower lipid levels.²⁰

In an effort to assess the latter possibility, a randomized study was conducted in which kidney transplant patients were randomized to receive an HMG-CoA reductase inhibitor (pravastatin), a triglyceride-lowering agent (gemfibrozil), or placebo. Despite statistically significant differences between lipid and triglyceride levels in the respective groups, the overall rate of rejection was similar in all 3 groups at 3 months.²¹ Although these findings are of interest, they do not address the question of whether the medications will have any benefit in long-term graft survival; at this time, they cannot be recommended for such an indication. For practical purposes, however, most kidney transplant patients have risk factors for coronary artery disease and elevated lipid levels that meet requirements for lipid reduction therapy by traditional criteria, meaning that most patients receive lipid-lowering drugs.

MONITORING FOR BONE DISEASE

As patients live longer with their allografts, they are exposed to greater total doses of immunosuppressive agents. Osteoporosis thus becomes a major health issue for both men and women with renal allografts. This

problem is compounded by the fact that patients often arrive at transplantation centers with established bone disease resulting from prolonged periods of dialysis. Further complicating matters, there is a high percentage of low-turnover bone disease in this population of patients,²² which makes therapy more problematic because of the concern that bisphosphonates are detrimental in low bone turnover states. Patients should be screened for osteoporosis using bone mineral densitometry (BMD). Regardless of BMD findings, however, all patients are encouraged to take supplemental calcium to ensure a daily intake of at least 1500 mg. Because most patients formerly received dialysis, special care should be taken to instruct them to take the calcium on an empty stomach so that the calcium is absorbed and does not act as a phosphate binder, as it does when taken with meals.

Vitamin D is prescribed only when appropriate for other conditions, such as the phosphate wasting that occurs when kidneys are transplanted into patients with elevated parathyroid hormone levels; in essence, this procedure converts their secondary hyperparathyroidism into primary hyperparathyroidism. Vitamin D therapy is often limited in any case by hypercalcemia. Similarly, estrogen replacement therapy is prescribed only when appropriate in consultation with an obstetrician, gynecologist, or other professional skilled in its use.

For kidney transplant patients with osteoporosis confirmed by BMD (ie, with a T score that is at least 2.5 SD less than the mean value for young healthy adults), bisphosphonate therapy should be prescribed only for those with documented high-turnover bone disease. High-turnover bone disease is defined as an increase in number of urinary cross-links or in serum levels of pyridinoline or deoxypyridinoline; it also involves cases in which the number of urinary cross-links does not place the patient squarely in the high-turnover bone disease category, but a high serum osteocalcin level exists.^{22,23} The bisphosphonate of choice is alendronate because it comes in a once weekly formulation. Efficacy of therapy should be assessed with yearly BMD. A successful outcome would be stabilization of or increase in bone density.

POSTTRANSPLANTATION GOUT

Gout occurs in a significant number of kidney transplant recipients. Although numbers vary, depending on the study cited, 10% of patients are generally affected.^{24,25} The percentage of patients with hyperuricemia is even greater. There is a decreased ability to excrete uric acid in kidney transplant patients that does not appear to be intrinsic to the kidney transplant itself; instead,

cyclosporine affects the kidney's handling of uric acid by decreasing proximal tubular secretion. Additionally, many patients with kidney transplants take diuretics, and the resultant volume depletion enhances uric acid reabsorption by the proximal tubule.

The clinical presentation of gout in kidney transplant patients is very similar to that in the general population. Whereas immunosuppression may slightly alter the threshold at which symptoms are perceived, once manifest, they are qualitatively and quantitatively the same (author's personal observation). Gout can occur at any time in the posttransplantation period. Anecdotally, patients who are predisposed to gout prior to transplantation manifest it sooner than do those who are not predisposed. As with gout in the general population, every effort should be directed toward making a diagnosis based on observation of crystals in fluid obtained from the affected joint.

Therapy of gout in kidney transplant patients requires special mention. Because nonsteroidal anti-inflammatory drugs compound the hemodynamic changes caused in the kidney by cyclosporine, they should not be used (as a general rule) in this population.^{26,27} Therefore, for acute attacks of gout in kidney transplant patients, the therapeutic options include cycling back to higher doses of corticosteroid (eg, prednisone 1 mg/kg body weight per day) and then tapering to a maintenance dose over 10 to 14 days, using colchicine first and then adrenocorticotrophic hormone (ACTH) or cosyntropin-mannitol (Cortrosyn) (if ACTH is unavailable). Although increasing the prednisone dose may seem to be the obvious choice, it should be remembered that kidney transplant patients, by virtue of their immunosuppressive regimen, already have a high exposure to corticosteroids. Therefore, it is appropriate to make an attempt to limit the amount of corticosteroids given. Colchicine is effective and reasonably safe to use. Two points regarding its use in kidney transplant patients must be remembered to avoid untoward events. First, in the presence of calcineurin inhibitors, colchicine-induced myopathy may occur at lower doses; and second, kidney transplant patients do not have a normal glomerular filtration rate, and, therefore, bone marrow toxicity may occur before gastrointestinal toxicity and diarrhea and limit systemic absorption. Another alternative, which is both safe and effective, is ACTH (40 to 80 units) or Cortrosyn in a therapeutically equivalent dose (400 to 800 µg), administered intramuscularly.^{28,29}

The cornerstone of management of chronic or tophaceous gout in kidney transplant recipients is allopurinol administered in dosages appropriate for the

degree of renal function, usually 100 to 200 mg daily. With the introduction of mycophenolate mofetil, the interaction between allopurinol and azathioprine is no longer a concern. It must be remembered, however, that many patients were started on azathioprine as part of their immunosuppressive regime; in these patients, allopurinol should not be used. Suppressing dosages of colchicine can also be used, provided that patients are monitored for signs (eg, proximal muscle weakness, unexplained increases in creatinine kinase levels) and symptoms (eg, tingling, aching) of colchicine-induced myopathy. Uricosuric agents in general have no place in the treatment of gout in this population, because the glomerular filtration rate is rarely such that any significant amount of uric acid would be cleared, leading to the development of uric acid stones and resultant acute renal failure.

PREGNANCY IN KIDNEY TRANSPLANT PATIENTS

As indicated earlier, kidney transplantation can restore fertility in female patients. Consequently, women should be advised to use birth control after receiving a kidney transplant. If a woman wishes to become pregnant, she should first discuss the possibility with the transplantation team so that proper plans can be made to alter dosages of immunosuppressive medications. Should a woman with a kidney transplant become pregnant, she should be referred back to the transplantation nephrologist for close follow-up during the pregnancy and antepartum period.

HEMATOLOGIC DISORDERS IN KIDNEY TRANSPLANT PATIENTS

Leukopenia is a common hematologic disorder experienced by patients after kidney transplantation. The differential diagnosis includes adverse effects of medication (both immunosuppressive and antiviral) and viral infections—most specifically, cytomegalovirus. A physician not specializing in transplantation medicine can check for the presence of cytomegalovirus antigen in the serum but then should refer the patient back to the transplantation team for actual interventions, such as modification of immunosuppressive medications.

Posttransplantation erythrocytosis (PTE) is a condition that affects 10% to 20% of kidney transplant patients.^{30–35} The etiology of this condition is unclear but does not appear to be related to an increase in erythropoietin production.³³ When hematocrit exceeds 50%, the risks associated with the increased viscosity of the blood increase dramatically, with cerebrovascular accidents being the clinically most common occurrence. A protocol for the treatment of PTE is shown in [Table 2](#).

Fortunately, PTE responds very predictably to angiotensin-converting enzyme (ACE) inhibitors and angiotensin II receptor blockers (AIIRBs).^{33,36–40} Just as the etiology of PTE is unclear, so too the mechanism of response to these medications is unknown. Usually, a low dose (eg, 2.5–5.0 mg of enalapril) administered orally once daily is all that is required^{33,36}; this dose can be titrated upwards, as needed. Although it seems that AIIRBs are less potent in terms of the degree of hematocrit reduction, this fact is clinically insignificant in most cases, because a large reduction in hematocrit is not required to reduce risks caused by hyperviscosity of the blood. However, it does take from 2 to 4 weeks for the drug's effect to become established.

Anemia occurs in kidney transplant patients most often as grafts fail. However, it is not uncommon for patients to have a hematocrit lower than would be expected, given the serum creatinine level. Work-up should consist of verifying that patients have adequate iron stores (eg, serum ferritin levels greater than 100 ng/mL, transferrin saturation > 15%) and checking serum erythropoietin levels. As erythropoietin production from the newly transplanted kidney increases, the available iron stores will be rapidly consumed. Patients become iron deficient approximately 6 months after transplantation. Checking an erythropoietin level serves 2 purposes: (1) it allows the physician to consider whether or not the anemia is caused by a poorly functioning allograft, and (2) it provides justification for starting therapy with recombinant erythropoietin. If the patient is on an ACE inhibitor or AIIRB and the level of erythropoietin seems appropriate for the anemia, the medication should be stopped, keeping in mind that if the medication was started to treat PTE, the result will be a rebound in hematocrit. However, if the physician determines that the ACE inhibitor or AIIRB is an essential component of the patient's medical regimen, the drug should be continued and erythropoietin administered. Experience indicates that ACE inhibitors and AIIRBs do not affect erythropoietin dosing. Although there is little in the way of published evidence, once weekly erythropoietin dosing with standard erythropoietin should be sufficient. The usual starting dose is 10,000 U subcutaneously, which subsequently can be increased, as needed. Currently there is no experience with long-acting erythropoietin in kidney transplant patients.

COUNSELING

General Concepts

Patients should be fully informed that a kidney transplant is not a cure for their renal disease but rather

Table 2. Yale University Protocol for Treating Posttransplantation Erythrocytosis in Kidney Transplant Patients

- Patients with hematocrits of 47% to 49.9% are instructed to consume at least 2 L of fluid daily and are started immediately on an angiotensin-converting enzyme (ACE) inhibitor or angiotensin II receptor blocker (AIIRB). The hematocrit and serum creatinine and potassium levels are monitored weekly until hematocrit decreases (in most cases, after 4 weeks of therapy).
 - Patients with hematocrits greater than 50% are sent for immediate phlebotomy, and 1 U of packed erythrocytes are removed. They are given a prescription for an ACE inhibitor or AIIRB and are instructed to consume a large amount of fluid. On the third day after phlebotomy, they are to begin taking the ACE inhibitor or AIIRB. Hematocrit and serum creatinine and potassium levels are monitored weekly from the day of phlebotomy until the hematocrit is satisfactory and stable. Once the hematocrit is stable, the routine follow-up regimen can be resumed. The physician can anticipate a stable course afterward, with a hematocrit between 37% and 42%.
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another form of renal replacement therapy. By receiving a kidney transplant, they are switching from one form of a chronic disease to another, and they must continue to play an active role in their own health care. This information is particularly useful in the long-term follow-up of kidney transplant patients. Once the excitement of getting a transplant has diminished, patients often are disappointed, because their lives do not return to what they were before their renal disease and kidney failure occurred. Patients are still required to take multiple medications multiple times each day; moreover, many of these medications have adverse effects, such as fatigue, loss of libido, weight gain, and unwanted hair growth.

Consequently, an essential part of the postoperative care of the kidney transplant patient is ongoing counseling. Late rejection of the allograft is very rare and almost always occurs in the context of noncompliance with medications. As patients begin to feel healthier, the burden of taking multiple medications several times each day becomes ever more onerous. For this reason, patients should be constantly reminded that long-term survival of their allograft depends on their compliance with medications and that no change in their immunosuppression regimen should be attempted without the involvement of the transplantation team.

Weight Gain

Excessive weight gain is a common problem after kidney transplantation. It occurs, for example, in kidney transplant patients taking prednisone, after their uremia has been relieved and overall health is improving. It has been anecdotally observed, in fact, that patients return to their predialysis weight. Nevertheless, patients should be encouraged to consume a balanced diet. There is evidence that a diet favoring proteins over carbohydrates can help ameliorate the adverse effects of corticosteroids regarding weight gain and weight distribution. Such a diet may involve a difficult adjustment for patients who have been on dialysis for long periods of time and are used to consuming a diet lower in protein.

Exercise

Following an exercise regimen is necessary in kidney transplant patients to help reduce their risk for cardiovascular disease and increase their bone mineral density. Whereas all forms of activity are beneficial, patients should be especially encouraged to pursue weight-bearing activities (eg, brisk walking, running, weight lifting), because mechanical loading of the skeletal system helps prevent osteoporosis; patients taking corticosteroids are at higher risk for osteoporosis than is the general population. Kidney transplant patients are advised to avoid contact sports; otherwise, all forms of physical activity can be pursued vigorously, as the US Transplant Games presented by the National Kidney Foundation attest.

Tobacco Use

Cessation of tobacco use is absolutely required in kidney transplant patients, and physicians caring for them should deliver this message unambiguously. The leading cause of death in transplant patients is cardiovascular disease. Diabetes mellitus and hypertension remain problems for most transplant patients, and immunosuppressive agents can accelerate arteriosclerosis. Tobacco use only makes this situation worse. Antismoking interventions (eg, nicotine patches, bupropion) can be safely used by kidney transplant patients.

Sun Exposure

As previously mentioned, immunosuppressive agents (eg, cyclosporinet, acrolimus) place patients at a higher risk for squamous cell carcinoma of the skin. Consequently, all patients—regardless of their degree of skin pigmentation—should be instructed to avoid sun exposure during peak sun hours, to use sunscreen at all times, and to wear protective clothing and hats.

CONCLUSION

Caring for kidney transplant patients is both challenging and rewarding. It is essential to be a good internist first, because kidney transplant patients will be susceptible to all the afflictions affecting the general population. Additionally, however, it is necessary to have a general understanding of how the renal allograft itself and a patient's immunosuppressive regimen will modify normal disease processes. **HP**

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