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## Renal Transplantation: Recipient, Donor, and Immunology

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# Renal Transplantation: Recipient, Donor, and Immunology

Stephen Corrigan Rayhill, MD, FACS

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## INTRODUCTION

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Renal transplantation is the preferred, definitive treatment for end-stage renal disease (ESRD). When successful, kidney transplantation offers most ESRD patients improved survival and quality of life compared with maintenance dialysis. Although dialysis successfully sustains life in the absence of an adequately functioning kidney, it does not maintain health over the long term. Working at an estimated 10% of the efficacy of a functioning kidney, dialysis provides only for the body's basic homeostatic needs. Furthermore, dialysis is associated with several problems not found in kidney transplant recipients, including chronic acidosis and electrolyte abnormalities, anemia, platelet dysfunction, water retention, hormonal imbalances, and often, severe hypertension. Over time, these problems exact a toll, especially on the cardiovascular system. For example, hypertension leads to atherosclerotic vascular disease and hypertrophic cardiac dysfunction,<sup>1</sup> and chronic hypercalcemia due to uremia causes premature calcification of the coronary arteries.<sup>2</sup> It is not surprising, therefore, that the majority of deaths in long-term dialysis patients are due to heart-related causes (Figure 1).<sup>3</sup>

Evidence that renal transplantation prolongs life comes from several sources. Using survival statistics tracked through the United States Renal Data System, it is evident that, compared with dialysis, transplantation prolongs the expected lifespan of ESRD patients by a factor of 2 to 3 for all age-groups (Table).<sup>4</sup> Further analysis of this national patient registry data by Wolfe and colleagues—after accounting for possible confounding factors such as age, race, sex, cause of ESRD, geographic region, time from the first treatment for ESRD to placement on the waiting list, and year of initial placement on the list—confirmed that renal transplantation extends life.<sup>5</sup> This analysis shows that, as expected, healthier ESRD patients are accepted for

transplantation and placed on the waiting list; the annual death rate for all ESRD patients was approximately 50% higher than that of those on the transplant waiting list. Most importantly, the authors demonstrated that the steady state risk of death after renal transplantation was approximately one third that of ESRD patients still on the transplant waiting list.<sup>5</sup> Renal transplantation is especially important for prolonging survival in diabetic patients with ESRD, in whom the overall 5-year survival on dialysis is dismal compared with renal transplantation—21%<sup>6</sup> for dialysis patients versus 72% to 94%<sup>7</sup> (depending on the type of renal transplant) for transplant recipients. Indeed, the risk of death among diabetic patients who receive a renal transplant is reduced by a factor of 10 compared with diabetic patients still on the waiting list.<sup>7</sup>

As the success of renal transplantation has made it the treatment of choice for ESRD, the number of patients on the waiting list for kidney transplantation has increased significantly. Unfortunately, there has not been a similar rise in the number of cadaveric donor kidneys available. As a result, waiting times are increasing (Figure 2).<sup>8</sup> On the other hand, it is encouraging to note that the number of living donors for kidneys has recently surpassed the number of cadaveric donors in the United States. According to the Organ Procurement and Transplantation Network (OPTN) database (available at [www.optn.org/data/citing.asp](http://www.optn.org/data/citing.asp)), 56,000 ESRD patients currently (as of September 2003) are on the renal transplant list in the United States. The database also shows that in 2002 there were 5631 deceased (formerly called *cadaveric*) donors, with 8539 deceased donor kidney transplants performed, and 6238 living donor kidney transplants (from the same number of donors). Adding pressure to the kidney shortage is the consistent finding that the longer an ESRD patient is on dialysis waiting for a suitable cadaveric kidney, the poorer the potential outcome.<sup>5,9–13</sup> Accordingly, the results are best when patients are transplanted before dialysis is necessary.