Survival Outcomes in Renal Transplantation in Trinidad and Tobago SORTTT Study

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ABSTRACT

Objective: *To assess patient and graft survival outcomes of renal transplant recipients from the National Organ Transplant Unit, Trinidad and Tobago.*

Design and Methods: *A retrospective descriptive analysis of renal transplants performed within five and half years (January 2006–June 2011) at the National Organ Transplant Unit was conducted. The age, gender, ethnicity, cause of renal failure, donor type, outcome and complications were examined. The one, two and three-year patient and graft survival rates were analysed and factors affecting them were discussed.*

Results: *A total of 73 renal transplantations were done. Seventy (95.9%) were from live donors and 3 (4.1%) from deceased donors. Thirty-eight patients (52.1%) were males and 35 (47.9%) were females. The one-year, two-year and three-year patient survival rates were 91.46% (SE 0.04), 89.51 % (SE 0.04) and 86.31% (SE 0.05), respectively. The one-year graft survival rate was 94.34% (SE 0.03). The two-year and three-year graft survival rates were the same at 92.69% (SE 0.03). The most significant complications seen in the recipients were those related to infections and cardiovascular disease: 47.9% of patients had a urinary tract infection, with the majority occurring at twelve months and 32.5% developed dyslipidaemia for the first time at six months. Seven patients developed erythrocytosis.*

Conclusion: *The patient and graft survival rates in this new transplant programme are acceptable. Complications which can occur in transplant recipients are common and have a significant impact on post-transplantation quality of life and survival. Thus, continuing assessment of co-morbid factors pre and post-transplantation as well as the analysis of donor and recipient factors will lead to an increase in both patient and graft survival.*

Keywords: Kidney transplant, survival outcomes, Trinidad and Tobago

Resultados de la Supervivencia de Transplante renal en Trinidad y Tobago Estudio RSTRTT

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RESUMEN

Objetivo: *Evaluar los resultados de supervivencia de pacientes y transplantes en relación con recipientes de transplante renal en la Unidad Nacional de Trasplante de Órganos de Trinidad y Tobago.*

Diseño y métodos: *Se realizó un análisis descriptivo retrospectivo de trasplantes renales de cinco años y medio (enero de 2006 – junio de 2011) en la Unidad Nacional de Trasplantes de Órganos. Se examinó la edad, el género, la etnicidad, la causa de la insuficiencia renal, el tipo de donante, la evolución clínica del paciente, y las complicaciones. Se analizaron las tasas de supervivencia de pacientes y transplantes, de uno, dos y tres años, y se discutieron los factores que las afectan.*

Resultados: *Se realizaron un total de 73 trasplantes renales. Setenta (95.9%) fueron de donantes vivos, y tres (4.1%) de donantes muertos. Treinta y ocho pacientes (52.1%) eran varones y 35 (47.9%) eran hembras. Las tasas de supervivencias de uno, dos y tres años relativas a los pacientes, fueron 91.46%*

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(SE 0.04), 89.51% (SE 0.04) y 86.31% (SE 0.05), respectivamente. La tasa de supervivencia de transplante de un año fue 94.34% (SE 0.03). Las tasas de supervivencia de transplante de dos y tres años fueron iguales, alcanzando un 92.69% (SE 0.03). Las complicaciones más significativas observadas en los recipientes fueron las relacionados con infecciones y la enfermedad cardiovascular: 47.9% de los pacientes tenían infección de las vías urinarias, teniendo lugar la mayoría de ellas a los doce meses, en tanto que el 32.5% desarrolló dislipidemia por primera vez a los seis meses. Siete pacientes desarrollaron eritrocitosis.

Conclusión: *Las tasas de supervivencia de pacientes y transplantes en este nuevo programa de trasplante son aceptables. Las complicaciones que pueden ocurrir en los recipientes son comunes y tienen un impacto significativo en la calidad de vida postransplante. Por lo tanto, continua evaluación de los factores co-mórbidos pre- y postransplante, así como el análisis de donantes y recipientes conducirá a un aumento de la supervivencia, tanto de los pacientes como de los transplantes.*

Palabras claves: transplante de riñón, resultados de la supervivencia, Trinidad y Tobago

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INTRODUCTION

In developing countries, chronic kidney disease is a major contributor to the nations' health and economic burden. It is a major cause of morbidity and mortality and diabetes and hypertension are leading contributory causes (1). Renal transplantation is the ultimate and preferred treatment for end-stage renal disease (ESRD) (2). Studies have shown that successful renal transplantation improves the quality of life and increases survival as compared to long term dialysis for ESRD patients (3–5). Recipients of kidney transplantation have a 68% lower risk of death compared to patients eligible for transplantation but who remained on dialysis (6). Although transplantation offers the best option for patients with ESRD, in developing countries, many of these patients may not have an opportunity for this type of treatment, since it may not be available or because of an organ shortage due to a limited donor pool (7).

In Trinidad and Tobago, renal transplantation is facilitated *via* the National Organ Transplant Unit (NOTU), which was established in January 2006. This agency is a vertical service of the Ministry of Health and its operations are governed by the Human Tissue Transplant Act No 13 of 2000 and the Human Tissue Transplant Regulations 2004. Douglas *et al* reviewed the early experiences with renal transplants in Jamaica showing the success associated with the procedure (8).

This paper assesses the one, two and three-year patient and graft survival rates over the five and a half year period (January 2006–June 2011). It also provides a descriptive analysis of renal transplant recipients' profiles and explores underlying factors that may adversely affect graft and patient survival.

SUBJECTS AND METHOD

This is a retrospective study that was approved by the Ethics Committee of the Faculty of Medical Sciences, The University of the West Indies. All information was obtained from patients' medical records at NOTU and at Eric Williams Medical Sciences Complex (EWMSC) and was accessible only to the investigators involved in the research. Patients' confidentiality was maintained as each name was coded when used for data analysis. All data were transcribed into the software SPSS Version 12.0 and was analysed using this statistical method.

All recipients of single kidney transplantation at NOTU from January 2006 to June 2011 were included. There were no exclusions. A standardized immunosuppression protocol consisting of steroids, calcinuerin inhibitors and an antiproliferative agent, mycophenolate mofetil, was used. Demographics obtained were: age at transplantation, date of transplantation, gender, ethnicity, cause of renal failure (hypertension, diabetes mellitus, polycystic kidney disease, chronic glomerulopathy, lupus and congenital causes), and patient outcome after one year (alive on dialysis, alive with functioning graft, deceased while on dialysis, deceased with a functioning graft). Donor characteristics that were collected were type of donor: live related (sibling-sibling, parent-child and child-parent), live unrelated (spousal and other) and deceased.

Complications post-transplantation at less than two weeks, one month, three months, six months, 12 months and > 12 months were recorded. These included: infections – urinary tract (diagnosed by microscopy and culture), chest infection (diagnosed by clinicians based on symptoms, clinical findings, laboratory and sputum findings),wound infection, viral warts/ulcers (diagnosed by clinicians) and those considered to be caused by specific viral agents; cardiovascular complications (myocardial infarction, stroke, dyslipidaemia [American Heart Association guidelines (8)], weight gain >10 lbs within one year), and new onset diabetes after transplantation [NODAT] (8), allograft factors [delayed graft function – need for dialysis within one week of transplantation (8)] and the need for renal biopsy were also recorded.

Complications of immunosuppressants – calcineurin inhibitors (gum hypertrophy, hirsutism), steroid complications (buffalo hump, acne, cushingoid facies osteoporosis – diagnosed by bone densitometry scanning) and erythrocytosis [haemoglobin >17 g/dL or a haematoctrit > 51% (8)] were noted.

Data were analysed using SPSS version 12 software and survival estimates were obtained by Kaplan-Meier survival curve methods.

RESULTS

From January 2006–June 2011, a total of 73 renal transplantations were performed. Seventy (95.9%) were from live donors and three transplantations (4.1%) from deceased donors. Thirty-eight (52.1%) patients were males and 35 (47.9%) were females. The ethnic composition and aetiology of ESRD are recorded in Table 1. In 50.7% of cases, no aetiology of the ESRD was known. There were 9 (12.3%) deaths during this study period. The one-year, two-year and three-year patient survival rates were 91.5% (SE 0.04), 89.5 % (SE 0.04) and 86.3% (SE 0.05), respectively (Table 2).

Table 1: Baseline data for all renal transplant recipients

	Patients (n = 73)	N (%)
Age (years)	**(mean, SD)**	**37.10 (15.59)**
Gender	Male	38 (52.1)
	Female	35 (47.9)
Ethnicity	East Indian	37 (50.7)
	African	26 (35.6)
	Mixed	9 (12.3)
	Chinese	1 (1.4)
Cause	Diabetes	3 (4.1)
	Polycystic kidney disease	3 (4.1)
	Hypertension	4 (5.5)
	Congenital	4 (5.5)
	Lupus	9 (12.3)
	Glomerulopathy	13 (17.8)
	Unknown	37 (50.7)
Donor type	**Live related donor**	**48 (65.8)**
	Sibling-sibling	22 (30.1)
	Parent-child	15 (20.5)
	Child-parent	11 (15.1)
	Live unrelated donor	**22 (30.1)**
	Spousal	5 (6.8)
	Other	17 (23.3)
	Deceased Donor	**3 (4.1)**
Outcome	**Alive:**	**64 (87.7)**
(after one year)	With functioning graft	62 (84.9)
	On dialysis	6 (8.2)
	Deceased:	**5 (6.8)**
	With functioning graft	2 (2.7)
	On dialysis	3 (4.1)
CMV IgG status	D+/R-**	6 (8.2)

** D+/R- Positive donor to negative kidney recipient

Table 2: Patient and graft survival rates

	One-year survival % (SE*)	Two-year survival % (SE*)	Three-year survival % (SE*)
Patient	91.5 (0.04)	89.5 (0.04)	86.3 (0.05)
Graft	94.3 (0.03)	92.7 (0.03)	92.7 (0.03)

*SE – standard error

The one-year graft survival rate was 94.3% (SE 0.03). The two-year and three-year graft survival rates were the same at 92.7% (SE 0.03). Figures 1 and 2 show the Kaplan and Meier estimates for patient and graft survival.

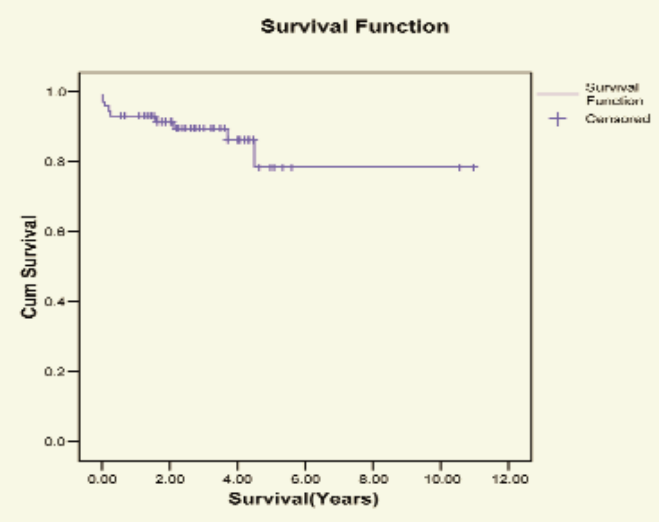

Fig. 1: Patient survival rates post-transplant.

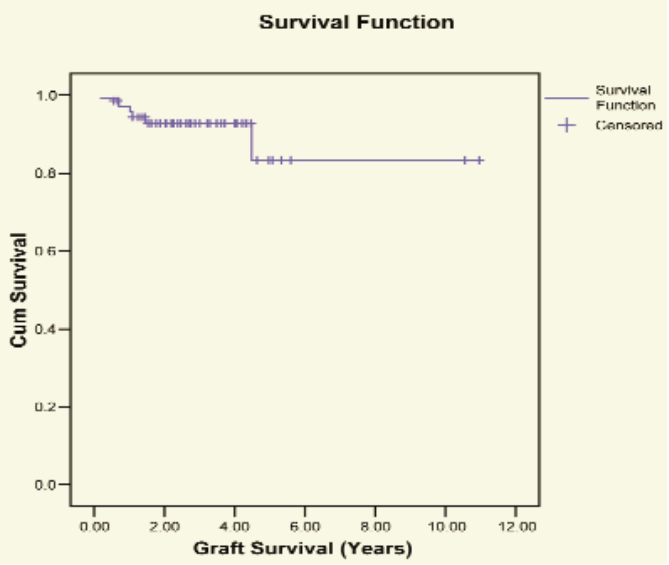

Fig. 2: Graft survival rates post-transplant.

Table 3 shows the occurrence of complications post-transplant. Infectious and cardiovascular complications were the most frequent. Urinary tract infection (UTI) was found to be the most common of all infections, occurring in 35 patients (47.9%), with the majority of them, 12 patients (34.3%), seen at 12 months. No atypical organism was found. The most common cardiovascular complication was dyslipidaemia, evident in 23 patients (31.5%) and first occurred in 11% of cases in the period six months post-transplantation. Myocardial infarction (5) occurred at any period post-transplant, but cerebrovascular accidents (1) were only noted in the immediate perioperative period. Sixteen of 73 patients (21.9%) developed significant weight gain after one year. Seven patients (9.6%) developed NODAT and in some, this was as early as the first month post-transplantation. With respect to allograft factors cited, the need for renal biopsy was most common in the 12-month period post-transplant. Delayed graft function occurred in seven patients with only one patient identified with primary graft failure. Seven patients (9.6%) developed erythrocytosis, mostly after six months post-transplantation.

Table 3: Occurrence of complications post-transplant in 73 patients with end-stage renal disease. Complications are shown at intervals post-transplant

Complication		Total no/ 73 (%)	< 2 wks N (%)	1 mth N (%)	3 mths N (%)	6 mths N (%)	12 mths N (%)	> 12 mths N (%)
	UTI**	**35 (47.9)**	4 (5.5)	7 (9.6)	2 (2.7)	3 (4.1)	12 (16.4)	7 (9.6)
INFECTION	Chest	**26 (35.6)**	0	2 (2.7)	3 (4.1)	4 (5.5)	8 (11.0)	9 (12.3)
	Viral	**15 (20.5)**	0	1 (1.4)	4 (5.5)	2 (2.7)	4 (5.5)	4 (5.5)
	Wound	**8 (11.0)**	5 (6.8)	2 (2.7)	0	0	0	1 (1.4)
	Surgical	**4 (5.5)**	3 (4.1)	0	1 (1.4)	0	0	0
ALLOGRAFT FACTORS	Delayed graft function	**7 (9.6)**	7 (9.6)	–	–	–	–	–
	Need for biopsy	**26 (35.6)**	2 (2.7)	2 (2.7)	5 (6.8)	2 (2.7)	6 (8.2)	9 (12.3)
CARDIOVASCULAR	Weight gain	**16 (21.9)**	–	–	–	–	16 (21.9)	–
	Dyslipidaemia	**23 (31.5)**	0	1 (1.4)	5 (6.8)	8 (11.0)	3 (4.1)	6 (8.2)
	NODAT*	**7 (9.6)**	1 (1.4)	3 (4.1)	1 (1.4)	0	2 (2.7)	0
	MI ^	**5 (6.8)**	0	1 (1.4)	0	1 (1.4)	1 (1.4)	2 (2.7)
	Stroke	**1 (1.4)**	0	1 (1.4)	0	0	0	0
IMMUNOSUPPRESSIVE THERAPY	Gum hypertrophy	**12 (16.4)**	0	1 (1.4)	5 (6.8)	1 (1.4)	2 (2.7)	3 (4.1)
	Hirsute	**18 (24.7)**	0	4 (5.5)	10 (13.7)	3 (4.1)	1 (1.4)	0
STEROID	Buffalo hump	**2 (2.7)**	0	0	0	0	0	2 (2.7)
	Acne	**14 (19.2)**	1 (1.4)	8 (11)	4 (5.5)	1 (1.4)	0	0
	Osteoporosis	**2 (2.7)**	0	0	0	0	1 (1.4)	1 (1.4)
	Cushingnoid	**19 (26.0)**	3 (4.1)	9 (12.3)	4 (5.5)	1 (1.4)	0	2 (2.7)
ERYTHROCYTOSIS	Hb >17g/dL	**7 (9.6)**	0	0	2 (2.7)	4 (5.5)	1 (1.4)	0

** UTI – urinary tract infection, *NODAT – new onset diabetes associated with transplantation, MI^ – myocardial infarction

DISCUSSION

Renal transplantation is the treatment of choice for patients with end-stage renal failure (9). With the advent of newer immunosuppression therapy, there have been improvements in short-term patient and graft survival rates. Some studies though, have shown that there is an initial increase in mortality soon after transplantation and the actual benefit of kidney transplantation occurs beyond 250 days of transplantation 10). Nevertheless, the risk of death for kidney transplant recipients is less than half that for dialysis patients (6).

The mean age for transplantation seen at NOTU was 37.1 years (SD 15.59). This can neither be considered too old nor too young, but was reduced because of the fact that seven children under the age of sixteen were transplanted under the auspices of Transplant Links Community, a non-profit charity based in the United Kingdom. The distribution of transplant recipients according to ethnicity is reflective of the ethnicity of the general population with regards to Africans, 26 patients (35.6%) and those of Chinese background (1.4%). East Indians, 37 patients (50.7%) was the predominant ethnic group receiving transplants. Whether this occurred because the demand or the supply of organs was greater in this group would require further examination.

Of the causes of ESRD, the highest frequency was the "unknown" category, comprising 37 patients (50.7%), followed by chronic glomerulopathy, 13 patients (17.8%) and lupus, 9 patients (12.3%). Given that the transplant programme is mainly living donor, this large unknown com-

ponent should not exist. The recipient as well as the donor should be suitably informed as to the risk of disease recurrence which can affect patient and graft survival both in the short and long term.

When compared to other developing countries, where their one-year patient survival is 93.7% and one-year graft survival is 93.0% (11), our results show a similar graft but not patient survival. The one-year patient survival rate at NOTU is 91.5 % (SE 0.04), while the one-year graft survival rate is 94.3% (SE 0.03). Our results indicate graft survival rates which are better than patient survival rates, for some patients died with functioning grafts. This may suggest that screening of recipients should be more stringent, particularly with respect to cardiovascular disease. Similar findings are seen in the two- and three-year patient and graft survival rates, respectively: two-year patient survival rate was 89.5% (SE 0.04) and three-year patient survival rate was 86.3% (SE 0.05), two-year and three-year graft survival rates were 92.7% (SE 0.03).

Further studies will need to be done to examine the recipient factors that affect patient survival, such as aetiology of initial disease, the presence of diabetes mellitus *versus* the other diseases, age at transplantation, length of time on dialysis and the gender of the recipients.

Some of the parameters affecting patient and graft survival in renal transplant recipients would be the complications seen post-transplantation. These include infection, cardiovascular complications, erythrocytosis, complications of steroid use and cancer. Other non-modifiable risk factors are older age of recipient (12) and female gender (13) which were not examined.

Urinary tract infection after kidney transplantation has been associated with patient mortality and graft failure (14). Graft failure results from free radical production, inflammatory cytokine response and pyelonephritis induced scarring (15). The present study showed 35 of 73 (47.9%) patients developed at least one episode of UTI, more commonly above 12 months post-transplant when according to the protocol used, co-trimoxazole was stopped. The incidence of UTI after renal transplantation varies widely in the literature from 6 to 86% (16–18). This can be explained by differences in the definition of UTI, the method of urinary sampling and the use or absence of preoperative and postoperative antibiotic prophylaxis (19). Urinary tract infection in the early post-transplant period is mainly caused by high dosage of immunosuppression after grafting, bladder catheters and surgery. Studies have shown that UTIs that occur at a later period after kidney transplant are normally “benign” and are seldom associated with structural abnormalities. They are easy to handle when diagnosed promptly and treated with a conventional course of antibiotic treatment (20).

Cytomegalovirus (CMV) and herpes simplex infections, herpes zoster, viral warts and oral ulcers (diagnosed clinically) were seen in 15 patients (20.5%). Cytomegalovirus is a frequent and important cause of clinical disease in kidney transplant recipients. In some studies, symptomatic CMV disease can be seen in approximately 8% of kidney transplant recipients (21). The present study showed that six donors (8.2%) were positive for CMV and donated to CMV negative recipients (D+/R-). Observational data suggest that D+/R- kidney transplant recipients are at the highest risk of developing severe CMV disease compared to all other kidney transplant recipients (22), resulting in both patient and graft demise. Studies in this high-risk population have shown that antiviral chemoprophylaxis reduces the incidence of CMV disease by about 60% (22). Note that all such patients in the present study were treated prophylactically with oral valgancyclovir but all except two have had to return to dialysis. Herpes simplex and herpes zoster infection are also potentially life-threatening to kidney transplant recipients and can affect patient survival. Treatment with oral acyclovir is a safe and effective treatment option once there is early detection (9).

Cardiovascular risk factors are another category of complications affecting patient and graft survival. Transplant patients in the present study had dyslipidaemia, NODAT and obesity. Pre-kidney transplantation cardiovascular risk factors often persist after kidney transplantation and can worsen in the post-transplantation period resulting in accelerated atherosclerosis (23). Observational studies in adult kidney transplant recipients have also reported an association between obesity, cardiovascular disease and mortality (9). The incidence and prevalence of dyslipidaemia is high in kidney transplant recipients because of some of the immunosuppressives. Agents implicated in causing dyslipidaemias include corticosteroids, cyclosporine and m-Tor inhibitors (9). Use of steroids and calcineurin inhibitors also increase the development of glucose intolerance (23). The risk of NODAT with tacrolimus is greater than with cyclosporine and is increased by obesity. Data from observational studies have shown that NODAT is associated with worse outcomes, including increased graft failure, mortality and CVD (24). The immunosuppression protocol in the review included use of tacrolimus or cyclosporine.

Twenty-three (31.5%) of the renal transplant patients showed dyslipidaemia, which was found as early as one month post-transplantation. Compared to other studies, the overall prevalence of dyslipidaemia during the first year after transplantation is > 50%. This high prevalence of dyslipidaemia justifies regular screening and monitoring (9). Sixteen (21.9%) patients developed significant weight gain of ten pounds after one year of follow-up, NODAT accounted for seven patients (9.6%), with most of the patients developing this at one month after transplantation. The cumulative incidence of NODAT by the end of the first year has generally been found in 10–30% of adults receiving cyclosporine or tacrolimus plus corticosteroids (24). Thus, it is imperative that these patients be assessed beyond the early years of transplantation and managed appropriately to increase long-term patient and graft survival.

The incidence of erythrocytosis varies from 8% to 22% among reports (25). Erythrocyctosis tends to occur within the first two years, as seen in the patients in the present study, but can occur much later. In kidney transplant recipients, erythrocytosis can be asymptomatic, or patients may complain of fatigue, headaches, plethora, dyspnoea or blurred vision (26). In the present study, there were seven (9.6%) such cases, with most occurring after six months of transplantation.

Delayed graft function was seen in 7 (9.6%) patients. This is a frequent complication of renal transplantation affecting 2 to 50% of recipients in different centres (27), particularly with respect to deceased donor transplantation. Surgical, donor or recipient factors which resulted in this would need to be further analysed, but the presence of true delayed graft function did not appear to play a role in graft survival.

Variables associated with the donor are important in determining graft survival. Studies have shown that an independent predictor of graft survival and recovery of renal function after transplantation is the donor age (28). Donor age was not assessed as a factor affecting graft survival in the present study. Other donor factors which were not included are HLA matching between donor and recipient, donor gender and the quality of the donor kidney. These factors would need to be assessed when a larger pool of transplant patients is obtained in the future.

In conclusion, the results of the study showed good patient and graft survival rates in a relatively new transplant programme in Trinidad and Tobago. Complications are common in transplant recipients especially in the short term and may have a significant impact on post-transplantation quality of life, patient and graft survival rates. Thus, continued assessment of the recipients' co-morbidity pre- and post-transplantation, examination of donor factors, categorizing the recipients' immunological risks and evaluation of short-term complications are essential for optimizing the kidney transplant recipients' patient and graft survival.

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REFERENCES

1. Agarwal SK, Srivastava RK. Chronic kidney disease in India: challenges and solutions. Nephron Clin Pract 2009; **111:** c197–c203.
2. Evans RW, Kitzmann DJ. An economic analysis of kidney transplantation. Surg Clin North Am 1998; **78:** 149–74.
3. Evans RW, Manninen DL, Garrison LP Jr, Hart LG, Blagg CR, Gutman RA et al. The quality of life of patients with end-stage renal disease. N Engl J Med 1985; **312:** 553–9.
4. Laupacis A, Keown P, Pus N, Krueger H, Ferguson B, Wong C et al. A study of the quality of life and cost-utility of renal transplantation. Kidney Int 1996; **50:** 235–42.
5. Russell JD, Beecroft ML, Ludwin D, Churchill DN. The quality of life in renal transplantation – a prospective study. Transplantation 1992; **54:** 656–60.
6. Wolfe RA, Ashby VB, Milford EL, Ojo AO, Ettenger RE, Agodoa LY et al. Comparison of mortality in all patients on dialysis, patients on dialysis awaiting transplantation, and recipients of a first cadaveric transplant. N Engl J Med 1999; **341:** 1725–30.
7. Sever MS, Kazanciolu R, Yildiz A, Türkmen A, Ecder T, Kayacan SM et al. Outcome of living unrelated (commercial) renal transplantation. Kidney Int 2001; **60:** 1477–83.
8. Douglas LL, Nicholson GD, Fletcher PR, Morgan AG. Renal transplantation in Jamaica. West Indian Med J 1981; **30:** 39–42.
9. Kidney Disease: Improving Global Outcomes (KDIGO) Transplant Work Group. KDIGO clinical practice guideline for the care of kidney transplant recipient. Am J Transplant 2009; **9 (Suppl 3):** S1–S155.
10. Karakayali H, Emiroglu R, Arslan G, Bilgin N, Haberal M. Major infectious complications after kidney transplantation. Transplant Proc 2001; **33:** 1816–17.
11. Al-Wakeel J, Mitwalli AH, Tarif N, Malik GH, Al-Mohaya S, Alam A et al. Living unrelated renal transplant: outcome and issues. Saudi J Kidney Dis Transpl 2000; **11:** 553–8.
12. Meier-Kriesche HU, Ojo AO, Hanson JA, Kaplan B. Exponentially increased risk of infectious death in older renal transplant recipients. Kidney Int 2001; **59:** 1539–43.
13. Maraha B, Bonten H, van Hooff H, Fiolet H, Buiting AG, Stobberingh EE. Infectious complications and antibiotic use in renal transplant recipients during a 1-year follow-up. Clin Microbiol Infect 2001; **7:** 619–25.
14. Rivera-Sanchez R, Delgado-Ochoa D, Flores-Paz RR, García-Jiménez EE, Espinosa-Hernández R, Bazan-Borges AA et al. Prospective study of urinary tract infection surveillance after kidney transplantation. BMC Infect Dis 2010, **10:** 245.
15. Khanna P, Abraham G, Mohamed Ali AA, Miriam PE, Mathew M, Lalitha MK et al. Urinary tract infections in the era of newer immunosuppressant agents: a tertiary care center study. Saudi J Kidney Dis Transpl 2010; **21:** 876–80.
16. Muller V, Becker G, Delfs M, Albrecht KH, Philipp T, Heeman U. Do urinary tract infections trigger chronic kidney transplant rejection in man? J Urol 1998; **159:** 1826–9.
17. Rubin RH. Infectious disease complications of renal transplantation. Kidney Int 1993; **44:** 221–36.
18. Sollinger HW, Knechtle SJ, Reed A, D'Alessandro AM, Kalayoglu M, Belzer FO et al. Experience with 100 consecutive simultaneous kidney-pancreas transplants with bladder drainage. Ann Surg 1991; **214:** 703–11.
19. Schmaldienst S, Horl WH. Bacterial infections after renal transplantation. Contrib Nephrol 1998; **124:** 18–33.
20. Grekas D, Thanos V, Dioudis C, Alivanis P, Tourkantonis A. Treatment of urinary tract infections with ciprofloxacin after renal transplantation. Int J Clin Pharmacol Ther Toxicol 1993; **31:** 309–11.
21. Paya C, Razonable R. Cytomegalovirus infection after organ transplantation. In: Bowden R, Ljungman P, Paya C, eds. Transplant infections. 2nd ed. Philadelphia: Lippincott, Williams and Wilkins; 2003: 298–325.
22. Hodson EM, Barclay PG, Craig JC, Jones C, Kable K, Strippoli GF et al. Antiviral medications for preventing cytomegalovirus disease in solid organ transplant recipients. Cochrane Database Syst Rev 2005: CD003774.
23. Karthikeyan V, Ananthasubramaniam K. Coronary risk assessment and management options in chronic kidney disease patients prior to kidney transplantation. Curr Cardiol Rev 2009; **5:** 177–86.
24. Kasiske BL, Snyder JJ, Gilbertson D, Matas AJ. Diabetes mellitus after kidney transplantation in the United States. Am J Transplant 2003; **3:** 178–85.
25. Kasiske BL, Vazquez MA, Harmon WE, Brown RS, Danovitch GM, Gaston RS et al. Recommendations for the outpatient surveillance of renal transplant recipients. American Society of Transplantation. J Am Soc Nephrol 2000; **11(Suppl 15):** S1–S86.

26. Gaston RS, Julian BA, Curtis JJ. Posttransplant erythrocytosis: An enigma revisited. Am J Kidney Dis 1994; **24:** 1–11.
27. Sharma AK, Tolani SL, Rathi GL, Sharma P, Gupta H, Gupta R. Evaluation of factors causing delayed graft function in live related donor renal transplantation. Saudi J Kidney Dis Transpl 2010; **21:** 242–5.
28. Remuzzi G, Cravedi P, Perna A, Dimitrov BD, Turturro M, Locatelli G et al. Long-term outcome of renal transplantation from older donors. N Engl J Med 2006; **354:** 343–52.