



Kidney transplantation in pediatric patients in Yucatán, Mexico: analysis of patient and graft survival

Trasplante renal en pacientes pediátricos en Yucatán, México: análisis de la supervivencia del paciente y del injerto

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ABSTRACT

Introduction: kidney transplantation is the treatment of choice for children with end-stage renal disease. However, data on patient and graft survival following pediatric kidney transplantation in Mexico remain limited. **Objective:** to assess patient and renal graft survival in a pediatric population in southeastern Mexico. **Material and methods:** this was an observational, retrospective, multicenter study conducted in tertiary care centers in southeastern Mexico. Patient and graft survival at one and three years post-transplantation were assessed using the Kaplan-Meier method. **Results:** a total of 45 pediatric kidney transplant recipients were included. The median age at transplantation was 15.1 years (range: 8-17), and 55.6% were female. Graft survival rates were 82% at one year and 77% at three years. Patient survival rates were 95% at one year and 91% at three years. Vascular complications were the leading cause of graft loss, while infections were the most common cause of death. **Conclusions:** the prognosis of pediatric kidney transplant recipients in the state of Yucatán is comparable to that reported in other national and international studies.

Keywords: chronic kidney disease, children, adolescents, kidney transplant, survival.

RESUMEN

Introducción: el trasplante renal es el tratamiento de elección para niños con enfermedad renal en etapa terminal. Sin embargo, en México existe información limitada sobre la supervivencia del paciente y del injerto tras el trasplante renal. **Objetivo:** evaluar la supervivencia del paciente y del injerto renal en una población pediátrica. **Material y métodos:** estudio observacional, retrospectivo y multicéntrico realizado en centros de tercer nivel de atención del sureste de México. Se evaluó la supervivencia del paciente y del injerto al año y a los tres años del trasplante mediante el método de Kaplan-Meier. **Resultados:** se incluyeron 45 pacientes pediátricos receptores de trasplante renal. La mediana de edad al momento del trasplante fue de 15.1 años (rango: 8-17), y el 55.6% eran mujeres. La tasa de supervivencia del injerto fue del 82% al año y del 77% a los tres años. La tasa de supervivencia del paciente fue del 95% al año y del 91% a los tres años. Las complicaciones vasculares fueron la principal causa de pérdida del injerto, mientras que las infecciones fueron la causa más frecuente de muerte. **Conclusiones:** el pronóstico de los pacientes pediátricos con trasplante renal en el estado de Yucatán es semejante a lo reportado en otros estudios.

Palabras clave: enfermedad renal crónica, niños, adolescentes, trasplante renal, supervivencia.

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INTRODUCTION

Chronic kidney disease (CKD) is an increasingly significant public health concern that also affects the pediatric population.^{1,2} In Mexico, however, epidemiological and demographic data on CKD in children remain scarce. As of 2014, the mortality rate from CKD among individuals under the age of 20 was estimated at 7.78 deaths per million.³

Kidney transplantation is regarded as the treatment of choice for children with end-stage renal disease, as it provides superior outcomes in neurological and psychological development, as well as overall quality of life, compared to dialysis modalities. While patient and graft survival rates in the pediatric population are generally comparable to those observed in adults, there is a notable lack of published data regarding these outcomes in Mexican pediatric kidney transplant recipients.^{4,5}

The objective of this study was to assess patient outcomes and graft survival in a cohort of pediatric kidney transplant recipients in Mexico.

MATERIAL AND METHODS

This was an observational, retrospective, and multicenter study conducted in tertiary care centers in southeastern Mexico. Data were collected from medical records. The following variables were recorded for recipients: age, sex, etiology of CKD, history of re-transplantation, serum creatinine levels at one and three years post-transplant, graft survival, causes of graft loss, patient survival at one and three years, and cause of death. Donor variables included age, sex, relationship to the recipient, and the surgical technique used for nephrectomy.

Statistical analysis

Descriptive statistics are reported as medians with 95% confidence intervals (95%CI). Associations between graft loss and its causes, as well as between mortality and related causes, were evaluated using odds ratios (OR) with 95%CI. Patient and graft survival were estimated using the Kaplan-Meier method. A p-value of < 0.05 was considered statistically significant.

RESULTS

A total of 45 pediatric kidney transplant recipients with a minimum follow-up of three years were included in the

study, with some patients having up to eleven years of follow-up. The median age at the time of transplantation was 15.1 years (range: 8-17), and 55.6% of the recipients were female. The most common etiology of CKD was unknown. Regarding donors, 77.8% of the transplants were from living donors (*Tables 1 and 2*).

Patient survival was 95% at one year and 91% at three years post-transplant (*Figure 1*). Graft survival rates were 82% at one year and 77% at three years (*Figure 2*). The median serum creatinine level was 1.69 mg/dL (95%CI: 0.68-2.70) at one year and 1.43 mg/dL (95%CI: 1.10-1.76) at three years.

The leading causes of graft loss were vascular thrombosis (n = 3) and chronic allograft nephropathy (n = 2). Reported causes of death included pneumonia in a patient with a functioning graft, heart failure associated with primary graft dysfunction, and systemic mycosis (*Table 3*).

The risk of death was significantly higher in patients who experienced graft loss compared to those who maintained graft function (OR: 18.6; 95%CI: 3.1-111). In contrast, re-transplantation was not associated with mortality, with an odds ratio of 0.94 (95%CI: 0.87-1.02).

Table 1: Demographic and clinical characteristics of 45 pediatric renal transplants recipients.

Characteristic	n (%)
Referral Mexican state	
Yucatán	29 (64.4)
Quintana Roo	12 (26.7)
Campeche	4 (8.9)
Sex	
Male	20 (44.4)
Female	25 (55.6)
Blood group and Rh	
O+	32 (71.2)
B+	6 (13.3)
A+	6 (13.3)
AB+	1 (2.2)
Diagnosis	
Chronic kidney disease of unknown etiology	37 (82.1)
Urinary tract malformation	3 (6.7)
Kidney hypoplasia	2 (4.4)
Alport syndrome	1 (2.2)
Bartter syndrome	1 (2.2)
Focal segmental glomerulosclerosis	1 (2.2)
Re-transplantation	
Yes	2 (4.4)

Table 2: Clinical characteristics of 45 renal transplant donors.

Characteristic	n (%)
Type of donation	
Living	35 (77.8)
Deceased	10 (22.2)
Family relationship	
Mother	20 (44.5)
Father	16 (35.5)
Sibling	5 (11.1)
Uncle	3 (6.7)
Friend	1 (2.2)
Laparoscopic nephrectomy	
Yes	8 (17.8)

DISCUSSION

Kidney transplantation has been performed in Yucatán since 1986, with published reports in the adult population demonstrating favorable outcomes in both patient and graft survival.⁶ However, data on pediatric kidney transplantation in this region remain limited. The state of Yucatán functions as a referral center for southeastern Mexico. Over the past 27 years, a total of 697 kidney transplants have been performed in the region, of which only 45 (6%) were in pediatric patients.

According to the North American Pediatric Renal Trials and Collaborative Studies (NAPRTCS) registry, approximately 80% of pediatric kidney transplants are performed in recipients older than six years of age. In the present study, most transplant recipients were adolescents, with no children under eight years of age or weighing less than 15 kg. These findings align with national trends, where kidney transplantation in younger or low-weight children remains uncommon.⁷

While CKD in adults is most commonly attributed to diabetic nephropathy, hypertension, autosomal dominant polycystic kidney disease, and chronic glomerulonephritis, pediatric CKD is typically caused by obstructive uropathy, glomerulosclerosis, renal dysplasia, and reflux nephropathy. In the present cohort, the etiology of CKD was unknown in 82.1% of cases, which is consistent with data from the Latin American Registry of Pediatric Transplants, where an unknown etiology has been reported in approximately 60% of pediatric CKD cases.⁸

Contemporary international data report one and three years graft survival rates of 93% and 95%, respectively⁹—figures that are notably higher

than those observed in our cohort (82% and 77%, respectively). Nevertheless, similar graft survival rates have been documented in other studies with higher incidences of acute rejection. For example, one study reported one and five years graft survival rates of 94.4% and 70.6%, respectively.¹⁰ In a Mexican cohort of 249 pediatric kidney transplant recipients, three years graft survival was reported at 80% for living-related donors and 68% for deceased donors. These findings highlight the influence of donor type on graft outcomes and provide a relevant national benchmark for comparison.¹¹

The relatively lower graft survival observed in our cohort may be partially attributed to the age distribution

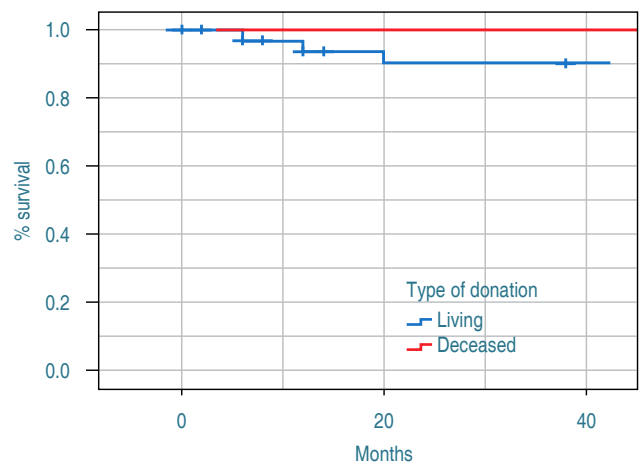
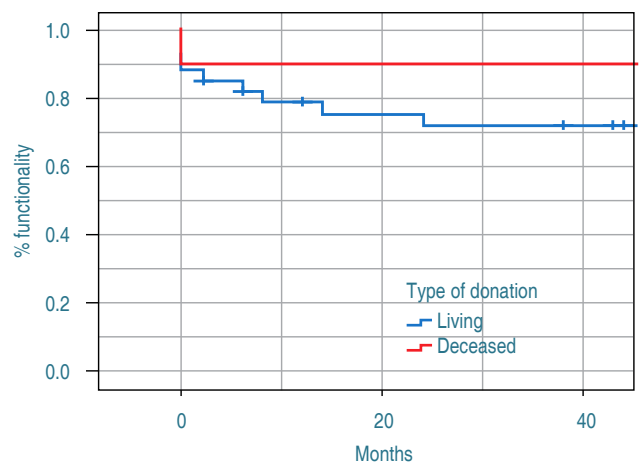
**Figure 1:** Patient survival at one and three years in pediatric kidney transplant recipients.**Figure 2:** Graft survival at one and three years in pediatric kidney transplants recipients.

Table 3: Causes of graft loss and death in pediatric renal transplants recipients.

	n	Period post-transplantation
Cause of graft loss (N = 10)		
Vascular thrombosis	3	Immediate
Chronic kidney allograft disease	2	14 and 24 months
Renal venous tear	1	Immediate
Primary graft dysfunction	1	Immediate
Fungal infection	1	1 month
Parvovirus	1	2 months
Polyomavirus	1	8 months
Cause of death (N = 3)		
Pneumonia with functional graft	1	12 months
Heart failure with primary graft dysfunction	1	6 months
Systemic mycosis	1	Immediate

of the population, which was predominantly adolescent. This age group has consistently demonstrated poorer long-term graft outcomes compared to younger pediatric patients. Smith et al. reported an estimated graft half-life of only seven years in adolescents, compared to 18 years in other pediatric age groups.¹² Moreover, late-onset acute rejection unresponsive to treatment accounts for 14% of graft losses in adolescents, versus 7% in younger children.¹³ One possible contributing factor is non-adherence to immunosuppressive therapy, which is more prevalent among adolescents. This non-adherence may be driven by a desire to avoid side effects such as acne, hirsutism, gingival hypertrophy, and weight gain.¹⁴

In our cohort, grafts from deceased donors appeared to demonstrate better early post-transplant stability. However, this observation may be influenced by the relatively small number of recipients of deceased donor organs. Over the long term, graft outcomes were similar regardless of donor type.

In this study, the most frequent causes of graft loss —vascular thrombosis and chronic allograft nephropathy— may be associated with the anatomical and physiological characteristics of the pediatric population, such as smaller vascular structures. Our findings are consistent with those reported by Srinath et al., who identified acute rejection as the leading cause of early graft loss in a cohort of 1,056 pediatric kidney transplant recipients. This aligns with the

early onset of chronic allograft dysfunction observed in our study.¹⁵

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Conflict of interests: the authors declare that they have no conflict of interests.