Abstract

Objectives: This study sought to evaluate graft outcome of kidneys from deceased-donor pediatric donors in adult recipients, and compare it with outcomes of kidney transplants from adult donors.

Materials and Methods: This historical cohort study involved 2 groups. Group 1 included 23 first kidney adult recipients who received their first renal transplant from pediatric deceased-donor donors. Group 2 consisted of 33 first renal transplant adult recipients with kidneys coming from adult deceased donors. The Kaplan-Meier method was used to generate graft survival and patient survival curves. The log-rank test was done to compare differences between survival outcomes.

Results: Graft survival rates at 1 and 5 years were 96% and 85% in group 1, and 91% and 85% in group 2. No significant difference existed in graft survival rates between the groups. Patient survival rates at 1 and 5 years in group 1 were 94% and 94% compared with 91% and 91% for group 2. No significant difference existed in graft survival rates between the groups.

Conclusions: This study demonstrates that with our experience, improvement in surgical technique and immunosuppressive therapy, pediatric deceased-donor kidneys may be considered as an alternate option for adult recipients. Renal transplants from pediatric donors into adult recipients is associated with good graft and patient survival outcomes.

Key words: Survival, Kidney transplant, Pediatrics

Introduction

Renal transplant is the best treatment for patients with end-stage renal disease. In Iran, since 1967, when the first living-donor kidney transplant was done, renal transplant practice has been increasing, with promising outcomes. Annually, kidney transplants have increased from fewer than 100 in 1986, to 1858 in 2000, and by the end of 2006, a total of 21 359 kidney transplants were done in Iran. However, the number of patients on the waiting lists is growing, and we are confronted with an ever-widening gap between supply and demand for organ donors. Consequently, pediatric deceased-donor kidneys comprise a considerable part of deceased-donor grafts that can expand the donor pool. Some studies have reported lower graft survival in pediatric kidney donors compared with adult kidney donors, while other studies have reported good graft function and satisfactory graft survival from pediatric deceased-donor kidney donors. It is difficult to explain this inconsistency, but it may be related to various technical aspects of surgical procedures (eg, microvascular surgical technique) and different immunosuppressive regimen (eg, mycophenolate mofetil).

This study sought to evaluate the graft outcomes of kidneys from deceased-donor pediatric donors given to adult recipients and to compare it with the outcome of kidneys transplant from adult donors.

Materials and Methods

This historical cohort study involved 2 groups: Group 1 included 23 first kidney adult recipients (aged ≥ 16 years) who received their first renal transplant from pediatric deceased-donor donors...
aged < 16 years. In this group, the mean donor age was 9.9 ± 3.5 years, and the mean recipient age was 27.7 ± 11.9 years. Patients who underwent an en bloc transplant were excluded from the study.

Group 2 patients consisted of 33 first renal transplant adult recipients (aged ≥ 16 years) with kidneys coming from adult deceased-donor donors aged ≥ 16 years. In group 2, the mean donor age was 30.6 ± 9.3 years, and the mean recipient age was 31.2 ± 12.0 years.

All transplants in both groups were performed at the Imam Reza Hospital, affiliated with the Mashhad University of Medical Sciences (MUMS), in Mashhad, Iran, between 2004 and 2009. The surgical techniques and the surgery teams were the same for both groups. After surgery, we use the same immunosuppressive regimens in both groups. All patients received an induction immunosuppressive protocol that consisted of methylprednisolone, mycophenolate mofetil, and cyclosporine. The maintenance immunosuppressive protocol consisted of mycophenolate mofetil or azathioprine, cyclosporine, and steroids. The mean follow-up for this study was 47.1 ± 27.2 months for group 1, and 48.5 ± 24.5 months for group 2.

Statistical analyses were performed with SPSS software (SPSS: An IBM Company, version 19.0, IBM Corporation, Armonk, NY, USA). The Kaplan-Meier method was used to generate graft survival and patient survival curves. The log-rank test was done to compare the differences between survivals. Patient survival and graft survival in the adult recipients of pediatric kidneys were compared with adult recipients of adult deceased-donor kidneys. In this comparison, adult recipients were ≥ 16 years old. In all cases, P values < .05 were considered statistically significant. The study was approved by the Vice-Chancellor of Research Ethic Committee of MUMS. All protocols conformed with the ethical guidelines of the 1975 Helsinki Declaration, and written, informed consent was obtained from all patients.

**Results**

The demographic and donor characteristics of the groups are outlined in Table 1. There were no significant differences between the baseline characteristics of either group. Three cases in group 2, and 1 case in group 1 received azathioprine, cyclosporine, and steroids as maintenance treatment; other patients in both groups received mycophenolate mofetil, cyclosporine, and steroids. There was no significant difference between the immunosuppressive regimens of either group (Table 1). Three patients in group 1 and 4 patients in group 2 had failed grafts. In group one, 2 patients died; and in group two, 1 patient died.

**Table 1. Demographic Characteristics of the Study Groups. All Quantitative Variables Are Summarized by Means ± SD, and All Qualitative Variables Are Summarized by Frequency (Percentages)**

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (n=23)</th>
<th>Group 2 (n=33)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean donor age</td>
<td>9.9 ± 3.5</td>
<td>30.6 ± 9.3</td>
<td>P = .000</td>
</tr>
<tr>
<td>Donor sex (F/M)</td>
<td>10/13</td>
<td>11/22</td>
<td>Not significant</td>
</tr>
<tr>
<td>Mean recipient age</td>
<td>27.7 ± 11.9</td>
<td>31.2 ± 12.0</td>
<td>Not significant</td>
</tr>
<tr>
<td>Recipient sex (F/M)</td>
<td>12/11</td>
<td>20/13</td>
<td>Not significant</td>
</tr>
<tr>
<td>Maintenance immunosuppression (mycophenolate mofetil/azathioprine)</td>
<td>22/1</td>
<td>30/3</td>
<td>Not significant</td>
</tr>
<tr>
<td>Cause of ESRD</td>
<td></td>
<td></td>
<td>Not significant</td>
</tr>
<tr>
<td>Glomerulonephritis</td>
<td>7 (30.4%)</td>
<td>10 (30.3%)</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>1 (4.4%)</td>
<td>6 (18.1%)</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>5 (21.7%)</td>
<td>6 (18.1%)</td>
<td></td>
</tr>
<tr>
<td>Neurogenic bladder</td>
<td>1 (4.4%)</td>
<td>1 (3.2%)</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>9 (39.1%)</td>
<td>10 (30.3%)</td>
<td></td>
</tr>
<tr>
<td>Recipient weight (kg)</td>
<td>45.3 ± 8.7</td>
<td>52.6 ± 13.3</td>
<td>Not significant</td>
</tr>
<tr>
<td>Mean dialysis time (mo)</td>
<td>15.2 ± 7.9</td>
<td>27.4 ± 29.0</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

**Abbreviations:** ESRD, end-stage renal disease
1 patient died. Graft survival rates at 1 and 5 years were 96% and 85% in group 1, and they were 91% and 85% in group 2. No significant differences existed in graft survival rates between the 2 groups ($P = .887$) (Figure 1). Figure 2 shows that the patient survival rates at 1 and 5 years in group 1 were 94% and 94% compared with 91% and 91% for group 2. No significant differences existed in patient survival rates between the 2 groups ($P = .360$).

**Figure 2.** Comparison of Patient Survival Curves Between the Groups ($P = .360$)

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**Discussion**

Currently, the number of potential kidney recipients awaiting renal transplant exceeds the number of kidney donors. Thus, researchers are working on every possible way of using donor kidney for transplants. One potential way is to perform a transplant from pediatric deceased donor into an adult or a pediatric recipient. The feasibility and outcomes of using pediatric deceased-donor kidneys for transplant into adult recipients remain controversial in managing end-stage renal disease. The present study—as a developing country experience—shows deceased-donor pediatric donor kidneys and deceased-donor adult donor kidneys give equal outcomes when transplanted into adult recipients. We found no significant differences between graft and patient survival in either the pediatric or the adult donor group.

The results of pediatric deceased-donor renal transplant have been suboptimal in the past, although recent data are more encouraging. Some studies report poor transplant outcomes when the renal donor is young.$^{4,5}$ Other studies confirm that deceased-donor pediatric donor kidneys and adult donor kidneys give equivalent results when transplanted into adult recipients.$^{7,8}$

Previous studies that report poor outcomes from pediatric donors have rationalized their results on 2 reasons. First, insufficient nephron mass induces hyperfiltration in the nephron. This overactivity and hyperfiltration results in hypertrophy and subsequent glomerular sclerosis of the overloaded nephron mass. This “hyperfiltration hypothesis” was proposed by Chanutin and Ferris for the first time in 1932.$^{3}$ In 1982, Bernner and associates detailed this theory and suggested that hyperfiltration-induced injury after a renal transplant is associated with significant size differences between the donor and recipient. This situation occurs in a renal transplant from a pediatric donor into an adult recipient.$^{11,12}$

Second, complications and graft rejections may be caused by surgical technical problems.$^{13}$

The present study shows good outcomes with transplants from deceased-donor pediatric donor kidneys into adult recipients. These good results may be due to several reasons: First, there are new immunosuppressive regimens for renal recipients. These drugs may improve graft survivals; but in our study, we did not assess the effect of different immunosuppressive regimens on graft survival, and we cannot make definitive conclusions regarding immunosuppressive regimens and graft survival. Second, development of radiologic interventions, like percutaneous angioplasty, decreases complications and graft loss.$^{3}$

There are 3 limitations that must be acknowledged and addressed regarding our study. First, the relatively small sample size of this study can affect the study power. Second, we did not assess the effect of medical history, immunosuppressive regimens, and other recipients’ factors on graft and patient survival. And third, we did not analyze the relation between renal and surgical factors (eg, renal weight, surgery time, and number of renal arteries) and graft survival.

In conclusion, this study showed that in our experience, in some developing countries, like Iran, with current surgical technique and immunosuppressive therapy, pediatric deceased-donor kidneys may be considered an alternate option for adult recipients. Renal transplant from pediatric donors into adult recipients is associated with good graft and patient survival.
References