Journal of Pediatric Urology (2017) 13, 279.e1–279.e7

Kidney transplantation in children weighing 15 kg or less is challenging but associated with good outcome

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Keywords
Pediatric kidney transplantation; Kidney; Infants; Postoperative complications; Graft survival

Received 15 October 2016
Accepted 2 February 2017
Available online 18 March 2017

Summary

Objective
Pediatric kidney transplantation (KT) in small children is assumed to be related to potential surgical complications that may cause severe morbidity and graft loss. The aim of our study was to analyze the outcome of KT recipients weighing ≤15 kg, focusing on surgical complications, associated morbidity and mortality, as well as allograft loss.

Methods
We reviewed our retrospective institutional database for recipients of KT between January 2000 and December 2014 with body weight ≤15 kg.

Results
Forty-four children weighing ≤15 kg, out of a total of 164 children (26.8%), received a deceased donor KT at our center during the study period. Mean weight was 10.10 ± 2.9 kg (3–15 kg), and weight was ≤10 kg in 23 patients (52.3%). The allograft was implanted intraperitoneally in two cases (4.5%) and extraperitoneally in the remaining 42 (95.5%). Two patients received a simultaneous double liver–kidney transplant. Postoperative complications appeared in 10 patients (22.7%) and eight required reintervention. Five allografts (11.4%) were lost secondary to surgical complications. No statistically significant differences in surgical complications were observed when compared with patients weighing >15 kg. Actuarial graft survival was 81% and 73% at 1 and 5 years, respectively. No significant differences in graft survival were observed compared with patients >15 kg. Mean follow-up was 84.95 ± 50 months (1–190 months).

Conclusions
Our results demonstrate that KT in children weighing ≤15 kg is challenging but not associated with increased risk of surgical complications or early graft loss.

http://dx.doi.org/10.1016/j.jpurol.2017.02.025

Introduction

Kidney transplantation (KT) is considered the treatment of choice in children with end-stage renal insufficiency. Nevertheless, KT in children with low weight (≤15 kg) is associated with potential surgical complications because of smaller vascular anastomosis, associated congenital anomalies, and disparity in vessel and body cavity size when adult donor organs are used [1−3]. These potential complications may cause serious morbidity, graft loss, and even death. Vascular thrombosis (VT) is one of the most feared complications leading to graft loss in almost 100% of cases [4,5].

Traditionally, the preferred surgical approach for small recipients was via a midline laparotomy with intraperitoneal placement of the allograft [6,7]. This approach has numerous disadvantages, among which intestinal complications are the most frequent [6]. The extraperitoneal approach has been questioned by many authors, because of presumed poor exposure and little space for vascular access and allograft placement.

Literature reports on KT in pediatric patients weighing ≤15 kg are scant. Our study aimed to analyze the outcome of our case series of KT recipients weighing ≤15 kg, focusing on surgical complications, associated morbidity, and mortality as well as allograft loss.

Materials and methods

We retrospectively reviewed our institutional database for recipients of pediatric KT performed between January 2000 and December 2014 weighing ≤15 kg, and identified 44 patients. Preoperative diagnosis, primary renal disease, type of transplantation, donor characteristics, surgical complications, and outcomes were collected. Additionally, surgical complications and graft survival were compared with those of patients weighing >15 kg. Graft loss was considered when transplantectomy was performed, the patient returned to dialysis, received a new KT, or died with a non-functioning graft.

Perioperative and postoperative care

Perioperative care paid particular attention to hemodynamic status and fluid replacement. All children were managed with aggressive hydration and even inotropic support if low flow was observed. Central venous pressure and body temperature were monitored in all patients. Immediately before revascularization, central venous pressure was maintained over 10 cmH_2O. All children underwent extubation in the operating room and were admitted to the intensive care unit for at least 24 h. Postoperative fluid replacement was based on urine output and hemodynamic status. Doppler ultrasound was performed early after surgery and daily for the first 4 days.

Since October 2012, we have used a protocol for antithrombotic prophylaxis that classifies patients into three risk groups: low, intermediate, and high. All recipients weighing ≤15 kg were at least at intermediate risk and received prophylaxis with oral/endovenous AAS (acetylsalicylic acid) 2 mg/kg every 24 h, starting at anesthesia induction and maintained until at least 1 month after KT. For those with additional risk factors (previous thrombosis, multiple vessels, thrombotic disorders, congenital nephrotic syndrome), sodium heparin in continuous infusion 10 U/kg/h was prescribed, beginning immediately after surgery and maintained for up to 1 week after KT, switching to AAS later on.

Standard immunosuppression consisted of induction with basiliximab on days 0 and 5, and triple therapy with corticosteroids, tacrolimus, and mycophenolate mofetil. In hypersensitized patients, induction therapy was based on ATG Fresenius (Fannin, Dublin, Ireland) or prophylactic antithymocyte globulins.

Surgical technique

For extraperitoneal placement, the iliac fossa was exposed through a J-shaped pararectal incision. The peritoneum was pushed away to expose the iliac vessels. Vascular anastomosis was performed in an end-to-side fashion to the external or common recipient iliac artery and vein. The kidney was implanted preferably on the right side. For intraperitoneal placement, a midline laparotomy was performed. Ureteral reimplantation was carried out using the Lich−Gregoire technique and a ureteral stent was left in place. We prefer to use ureteral catheters externalized across the bladder and through the skin to directly monitor the graft diuresis than double J stents. Besides, these catheters do not require another general anesthesia for removal. Native nephrectomy was performed simultaneously in cases of lack of space. Small donor kidneys were transplanted as single kidney grafts and never as en bloc kidneys.

Statistics

Descriptive statistics were produced for surgical complications and allograft survival. The Pearson chi-square test and the Fisher exact test were used to assess whether there was a significant difference in surgical complications and allograft survival when compared with patients weighing >15 kg. Graft survival was analyzed with the Kaplan−Meier actuarial survival tables. A two-sided $p < 0.05$ was considered to indicate statistical significance. Statistical analysis was performed with SPSS 15.0 software.

Results

Between January 2000 and December 2014, 164 KT were performed at our institution. Forty-four (26.8%) were ≤15 kg in weight and all received a deceased donor graft.

Recipients

Patient characteristics are listed in Table 1. The mean age at transplantation was 2.5 ± 2 years (0.6−11.5 years) and mean weight was 10.10 ± 2.9 kg (3−15 kg). Twenty-three (52.3%) weighed ≤10 kg. In two patients with extremely low weight (3.2 and 3 kg) KT was performed as rescue therapy as a result of congenital nephrotic syndrome