

Preoperative Risk Factors Associated With Urinary Complications After Kidney Transplantation

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ABSTRACT

Background. Only surgically irrelevant risk factors including sex, African-American ancestry, or exceptional U-stitch anastomosis have been identified to associate with urinary complications after kidney transplantation. The objective was to identify modifiable and nonmodifiable risk factors associated with urinary complications after kidney transplantation.

Methods. A single-center study of 3,129 kidney transplants performed over 40 years was conducted to identify independent risk factors using χ^2 tests and logistic regression analysis.

Results. We identified the quality of the transplant's ureter, cystographic abnormalities in the recipient, and repeat transplantations as independent risk factors for overall urinary complications occurring after kidney transplantation in multivariable analysis. Obesity was associated with an increased risk of urinary fistula, while the presence of a JJ stent was associated with a reduced risk of urinary fistula. The risk of urinary surgical complications for kidney transplantations was reduced when the kidney was recovered from a living related compared to a deceased donor.

Conclusions. The risk factors identified in the present study will allow candidates for kidney transplantation to be more informed and will also allow for surgical modifications to limit the occurrence of urinary complications.

CANDIDATES for kidney transplantation undergo preoperative assessment to confirm feasibility, to optimize conditions, and to identify potential risks of the transplantation. Urinary complications frequently happen after kidney transplantation, with urinary fistula usually occurring in the early postoperative phase, whereas urinary strictures can occur ranging from days to years after transplantation. Because complications associated with contemporary kidney transplantations can be diagnosed and treated earlier, the impact of these complications on the kidney's function and the recipient's survival is less significant [1–3]. Nonetheless, urinary complications may involve subsequent in-hospital complications, incisional or endourologic repeat surgery, and/or readmissions [4,5]. The JJ stent in particular is widely accepted by a majority of surgical teams and can be used during urinary anastomosis to reduce the risk of complications [6]. Aside from the JJ stent, consensus is lacking regarding which risk factors will better inform recipients and

ultimately prevent urinary complications. Because only surgically irrelevant risk factors for complications including sex, African-American ancestry, and exceptional U-stitch anastomosis have been identified [7], the aim of this study was to identify surgically relevant risk factors of urinary complications after kidney transplantation in a large, single-center, historical series performed across 4 decades.

METHODS

All kidney transplantations performed consecutively in a single center from 1971 to 2011 were included in the study. The organs were locally recovered from deceased donors (brain-death or

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Table 1. Characteristics of Urinary Anastomoses

Total	n = 3129	
Type of anastomosis		
Ureteroureteral	284	9.1%
With JJ stent	50	17.6%
Lich-Gregoir	1897	60.6%
With JJ stent	1540	81.2%
Leadbetter	895	28.6%
With JJ stent	26	2.9%
Special*	22	0.7%
With JJ stent	16	72.7%
JJ stent		
Yes	1634	52.2%
No	1469	46.9%
Ureter length		
Short (<10 cm)	2992	95.6%
Long (>10 cm)	84	2.7%
Special†	28	0.9%
Voiding cystourethrogram		
Normal	2806	89.7%
Reflux	137	4.4%
Special‡	158	5.0%

*Anastomosis in ileal conduit/neobladder/cystoplasty/psaic bladder/crossed anastomosis.

†Ureteral duplication/devascularization/pyeloureteral junction/hydronephrosis.

‡Small capacity/benign prostatic hyperplasia/cystoplasty/ileal conduit/diverticulum/urethral stenosis/bilharziosis/diabetes.

non-heart-beating donors) or from living donors, or were distributed according to national distribution rules. During recovery of the kidney, the ureter was sectioned beyond the iliac vessels. After 1984, the ureter was recovered with the periureteric fatty tissue preserved during the preparation of the transplant. Evolution of the urinary anastomosis technique throughout the study occurred as follows: ureteroureteral from 1971 to the early 1980s, ureterovesical according to Leadbetter-Politano without JJ stent during the 1980s, and ureterovesical according to Lich-Grégoire with a JJ stent since the early 1990s. Primarily, 2 continuous slowly absorbable monofilament sutures were used. The transplantation database was prospectively maintained including data on recovery of kidney, transplantation, and postoperative and long-term follow-up [8]. Recovery data included kidney side, vital status of the donor, number of arteries, ureteral length (long was defined as greater than 10 cm from the pyeloureteral junction). Ureters that had occasionally been defatted during recovery were separately considered in the statistical analysis. Transplantation data included recipient sex, obesity (defined as a body mass index greater than 35 kg/m²), history of previous transplantation, site of transplantation, surgeon's experience (<20 vs >20 transplantations performed by each surgeon in our center); type of urinary anastomosis (ureteroureteral, ureterovesical [ie, Lich-Gregoir, Leadbetter], and special [ie, anastomosis in ileal conduit, neobladder, cystoplasty, psaic bladder and crossed anastomosis]), presence of a JJ stent, and preoperative voiding cystourethrogram (VCUG) result (ie, normal, reflux, special [ie, benign hypertrophy of the prostate (BHP), small capacity, urethral stenosis, cystoplasty, ileal conduit, diverticulum, bilharziosis, neurogenic bladder dysfunction]).

Postoperative data included diuresis, serum creatinine, drainage, ureteral stenosis or leakage and the patient's eventual radiologic or surgical treatment. The diagnosis of ureteral stenosis was made through a combination of dilated pyelocaliceal cavities of the kidney

transplant and an alteration of its function. Ultrasound and serum creatinine were routinely requested 1 and 3 months after surgery. The diagnosis of fistula was made if there was urine leakage (biochemically confirmed) from the surgical wound or in the drainage, or if a fluid collection was opacified at a late excretory phase imaging. Early surgical complications were defined as time to onset within 3 months of surgery, and late surgical complications as time to onset beyond 3 months after surgery. Statistical analyses were performed with SAS version.9.2 (SAS Institute Inc, Cary, North Carolina, United States). A statistical significance level of $P < .05$ was set for all statistical tests. All P values are 2-tailed. Pearson's χ^2 test was used to compare categorical data. For further analysis, all estimated parameters were presented in binary variables. Presence of any complication was considered as the binary dependent variable. The univariate analysis of all types of complications was performed with Pearson's χ^2 test and with logistic regression to adjust for age. The covariates significantly associated with any complication were retained for multivariate analysis by logistic regression.

RESULTS

A total of 3129 kidney transplantations were consecutively performed from 1971 to 2011. Kidneys were recovered from brain deceased donors (88.6%), living donors (7.5%), or donors after cardiac death (3.9%). There were 2822 (90.2%) single kidney transplantations (with 9.5% and 1.0% second and third transplants, respectively), 126 (4.0%) pancreas + kidney transplantations, 131 (4.2%) liver + kidney transplantations, and 50 (1.0%) double kidney transplantations performed during this time. Recipients had a mean age of 58 (± 12) years and of these recipients, 63% were male. The characteristics of urinary anastomoses are presented in Table 1. The type of anastomosis most frequently performed was ureterovesical, according to Lich-Gregoire (60.6%) with a JJ stent (52.2%), on a short ureter (95.6%) in patients with a normal VCUG (89.7%). The overall rate of urinary complications was 11.2% (352 events) and included stenosis (5.4%), fistula (4.0%), lithiasis (1.0%), and symptomatic reflux (1.6%). The time to onset is listed in Table 2. The results of the regression analyses are presented in Table 3 and Fig 1. Adjusting for age, special anastomoses (ileal loop, enterocystoplasty, contralateral

Table 2. Type and Time to Onset of Complications

Urinary complications	352	11.2%
Early (<3 mo)	192	51.1%
Late (>3 mo)	184	48.9%
Stenosis	168	5.4%
Early (<3 mo)	70	41.7%
Late (>3 mo)	98	58.3%
Fistula	126	4.0%
Early (<3 mo)	117	92.9%
Late (>3 mo)	9	7.1%
Lithiasis	31	1.0%
Early (<3 mo)	5	16.1%
Late (>3 mo)	26	83.9%
Reflux	51	1.6%
Early (<3 mo)	0	0.0%
Late (>3 mo)	51	100.0%

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