Evaluation of Ureteral Stent Colonization in Live-Donor Renal Transplant Recipients

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ABSTRACT

Background. Ureteral stent insertion during kidney transplantation is a matter of debate. Stenting has been proven to reduce the risk of surgical complications. In addition, it has been reported to increase risks such as urinary tract infections especially after operation. Ureteral stent colonization (USC) is known to play a role in the pathogenesis of stent related-infections. The aim of this study was (1) to assess the frequency of USC and values of urine cultures in identifying colonizing bacteria; (2) to assess the importance of indwelling time for USC in live-donor renal transplant recipients; and (3) to evaluate the biomarker role of neutrophil-to-lymphocyte ratio (NLR) on USC.

Methods. A total of 107 live-donor kidney transplant patients were included in the study (76 men and 31 women). The mean age was 43.7 years, and average indwelling time of the ureteral stent was 24.7 days. Patients were divided into three groups according to indwelling stent time as group 1: 15 to 21 days (3rd week), group 2: 22 to 28 days (4th week), and group 3: 29 to 35 days (5th week). The decision to remove the stent was primarily based on clinical judgment. Ureteral stents were removed with the use of flexible cystoscopy. Midstream urine for urine culture and blood samples for NLR were taken prior to stent removal. The removed stents were divided into three parts and taken for bacteriological investigation.

Results. Of 107 patients, USC was detected in 24 (22.4%) patients, whereas urinary proliferation was observed in 8 (7.4%) patients. The most common microorganisms found in USC was the *Enterecoccus* species. The most common microorganisms in urinary culture were *Enterecoccus spp*. and *Klebsiella pnemoniae*. All patients with isolated microorganisms in the urine had USC ($P < .001$). On the other hand, proliferation in urinary culture was observed only in 30% of patients. Urine culture was not significant in identification of USC ($P = .063$). The three patient groups that were determined according to indwelling stent time were compared in terms of USC, proliferation in urine culture, and NLR. The highest incidence of USC was found in group 3 (44%) and the least in group 2 (11%) ($P < .05$). No significant difference was found between the groups in terms of urine culture ($P = .546$). Although no significant difference was found between groups 1 and 2 in NLR values ($P = .755$), NLR was significantly higher in group 3 ($P = .026$).

Conclusions. Colonization is common in ureteral stents inserted in live-donor kidney transplant patients, although routine urine culture is insufficient in identfying this

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colonization. The most common microorganism detected in ureteral stent colonization was *Enterecoccus spp.* The 4th week was the most convenient time for stent removal time in terms of USC among the 3rd, 4th, and 5th weeks. In addition, increased NLR might have value as a biomarker for USC.

UROLOGICAL complications after kidney transplantation (KT) are associated with significant morbidity such as graft loss and death [1,2]. Extra-vesical ureteroneocystostomy has become the standard technique for re-establishment of urinary tract continuity in KT. The indwelling ureteral stent of this ureterovesical anastomisis is commonly used to prevent urologic complications such as urine leakage and strictures [3,4]. Actually, it is not clear whether ureteral stents are of benefit. Controlled trials have recommended routine ureteral stent insertion to decrease the incidence of postoperative urologic complications [5–7] On the other hand, two studies denied the significance of stenting and even described an increase in the incidence of associated urinary tract infection (UTI) [8,9]. Like all synthetic medical intra-cavitary devices, ureteral stents offer an ideal surface for bacterial colonization [10,11]. In indwelling ureteral stents, bacterial colonization in the stent plays an essential role in the pathogenesis of stent-associated infection [12,13]. The aim this prospective study was to (1) assess the frequency of ureteral stent colonization (USC) and the value of urine culture in identification of colonizing bacteria; (2) assess the importance of indwelling time for USC in live-donor renal transplant recipients; and (3) to evaluate the biomarker role of neutrophil-to-lymphocyte ratio (NLR) on USC.

METHODS

This study was a prospective analysis of a series of consecutive patients after kidney transplantation. The study was approved by the local human subjects commitee, and all patients gave written informed consent. One hundred sixteen consecutive patients (81 men and 35 women), between January and May of 2016, underwent kidney transplantation, and pre-operative ureteral stents were routinely placed. One hundred ten recipients were live-donor and 6 recipients were cadavar-donor. Patients receiving antibiotics other than co-trimoxazole during stent removal and cadavar-donor renal transplant recipients were excluded from the study in terms of standardization.

A total of 107 live-donor kidney transplantation patients were included (76 men and 31 women). The mean age was 43.7 ± 14.92 years (range, 12–73). All of the stents were 4.7F 15 cm and made of polyuretan. As maintenance therapy, an anti-proliferative agent, calcineurin inhibitor, and steroid treatment were given to all recipients as a standard protocol. At the time of stent removal, all patients were recieving *Pneumocytis jirovecii* prohylaxis with co-trimoxazole 400 mg once a day. The average indwelling time of the ureteral stent was 24.7 (15–35) days.

Patients were divided into three groups according to indwelling stent time: group 1, 15 to 21 days (3rd week); group 2, 22 to 28 days (4th week); and group 3, 29 to 35 days (5th week). The decision to remove the stent was primarily based on clinical judgment. Ureteral stents were removed under aseptic conditions with the use of flexible cystoscopy. Midstream urine culture and blood samples were taken prior to stent removal during cystoscopy. Under sterile conditions, the removed stents were divided into three parts; 1 cm of proximal and distal ends of stents were cut off and taken for bacteriological investigation. The processed segments of the catheter were placed in sterile test tubes. To wash out the intraluminal part of the catheter, in which microorganisms had attached to the inner surface, 1 mL of sterile tryptic soy broth solution was injected into the inner surface of the catheter segments with a 21-gauge needle syringe. Then the liquid culture medium was vortexed for 1 minute to enable the detection of microorganisms attached to the outer surface of the catheter segment. Samples were inoculated onto blood agar and eosin methylene blue agar. Plates were incubated for 48 hours at 37°C. The microorganisms that grew on the agar were evaluated quantiatively (growth of >1000 colony-forming units/mL was considered significant). Bacteria were identified by means of the conventional method.

Blood samples were obtained with the use of a vacutainer and collected in tubes containing standard K2-EDTA. Determination of hematological parameters was made with the use of a Sysmex 1000i analyzer (Sysmex, Kobe, Japan). Complete blood count analysis was performed within 2 hours after blood sampling. NLR was calculated as a simple ratio of the absolute neutrophil/lymphocyte counts.

Statistical Analysis

All statistical analyses were performed with the use of SPSS statistical software (SPSS for Windows, version 22.0; SPSS Inc, Chicago, Ill, United States). Continuous variables are presented as mean ± standard deviation (SD). The normality of data distribution was determined by means of Kolmogorov-Smirnov or Shapiro-Wilk tests. Numeric values compatible with the normal distribution were compared by use of a one-way analysis of variance (ANOVA) test. Data corresponding to an abnormal distribution were compared by use of the non-parametric Kruskal-Wallis test.

In the other analysis, the χ^2 test and ANOVA were used, and a value of $P < .05$ was regarded as statistically significant.

RESULTS

USC was observed in 24 patients (22.4%) and proliferation in urine culture in 8 patients (7.4%) of the 107 patients included. The most common microorganisms detected in USC in order of frequency included *Enterecoccus spp.* in 14 patients, coagulase-negative (CoN) *Staphylococcus* in 3 patients, *Klebsiella pneumoniae* in 3 patients, and *Candida spp.* in 2 patients. *Enterecoccus spp.* was detected in urine cultures of 3 patients, *K pneumoniae* in 3 patients, and *Candida spp.* in 2 patients (Table 1).

USC was found in 13 (17.1%) of 76 male patients and 11 (35.5%) of 31 female patients. USC and positive urine culture (PUC) were significantly higher in women than in