Urinary tract infection in patients after renal transplantation: evaluation of risk factors

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RUNNING TITLE
Urinary tract infection in patients after renal transplantation: evaluation of risk factors

KEYWORDS
kidney transplantation, urinary tract infections, standard antibiotic prophylaxis, risk factors

WORD COUNT
1925

CONFLICT OF INTERESTS
no conflicts of interest

ABBREVIATIONS
CFU – colony-forming units
DDs – deceased donors
DGF – delayed graft function
eGFR – estimated glomerular filtration rate
ESBL – extended spectrum β-lactamase producer
ESBL (+), extended spectrum β-lactamase positive,
ESBL (-), extended spectrum β-lactamase negative;
HLA – human leukocyte antigen
HLAR – high-level aminoglycoside-resistant strains of enterococci
IGF – immediate graft function
KTx – kidney transplantation
MBL (+), metallo-β-lactamase - positive,
MBL (-), metallo-β-lactamase - negative;
MDR – multi-drug resistant
NODAT – new-onset diabetes after transplantation
PRA – Panel Reactive Antibody
SAP – standard antibiotic prophylaxis
UTI – urinary tract infection
VRE – vancomycin-resistant enterococci

Standard Antibiotic Prophylaxis, which appears to be over-aggressive, can lead to colonization by microorganisms resistant to treatment, so identifying relevant perioperative UTI risk factors is crucial for optimizing prevention strategies in individual patients.
ABSTRACT

Background: Kidney transplantation is currently the best method of renal replacement therapy in patients with chronic renal failure. A common complication in renal transplantation patients is urinary tract infection (UTI). We assessed UTI risk factors in kidney recipients from deceased donors and its impact on graft function and survival.

Material and Methods: Retrospective analysis was applied to a group of 220 patients who underwent the transplant procedure in 2010 and 2011. Patients were divided into two groups: patients diagnosed with UTI in the first month post-transplant (n=55) and patients without UTI (n=165).

Results: Statistically significant risk factors for increased UTI included receiving a kidney from a donor with expanded criteria, lower flow in the fourth hour of mechanical perfusion (<120 ml/min), lower HLA compatibility (>4 mismatches), operation time (<200 min), the occurrence of delayed graft function, post-transplantation diabetes mellitus, and urological complications after transplantation. Patients with UTI experienced a significantly prolonged hospital stay (28 days vs. 15 days, p=0.01). Factors such as gender, age, body mass index, duration of dialysis in the recipient, length of surgery, type of immunosuppression used, and one-year graft survival rates did not differ between the two groups.

Conclusions: ECD donor, 4 and more mismatches in HLA compatibility, long surgery time and lack of IGF are the predicting pre-transplant factors of UTI. Analyzing known risk factors before transplantation, (with reference to factors possible to occur after Tx) could determine how UTI prophylaxis is to be administered.

BACKGROUND

Kidney transplantation (KTx) is currently the best method for treating patients with end-stage renal disease (1,2), although burdened by possible complications such as hemorrhage, urinary fistula, lymphocele (3), infections, including urinary tract infections (UTI) as the most common (4,5), accounting for approximately 40-65% of all infectious complications and often leading to morbidity and allograft failure (6,7,8). Incidence of UTI in patients in the first year after KTx ranges from 20% to 76%, depending on the transplant center (9,10,11,12). Variation in reported incidence may be due to differences in follow-up time, population studied and in definitions in UTI detection (13,14). UTI which occurs in the first month after transplantation is evaluated to vary from 2,3% - 56,7% (5,14,15,22-27). Because each clinical center applies its own prophylactic regimen to KTx patients, it is unclear if established standard antibiotic prophylaxis (SAP) and empirical testing methods are universal to all patient populations (15). SAP, which appears to be over-aggressive, can lead to colonization by microorganisms resistant to treatment (5), so identifying relevant perioperative UTI risk factors is crucial for optimizing prevention strategies in individual patients. Although the duration of SAP in KTx patients has not been standardized, there is a current trend toward a decreased use of antibiotic prophylaxis for renal transplantation. In this study, we defined the incidence of UTI in patients after renal transplantation, assessed the prevalence and nature of UTI by identifying its risk factors, and identified a group of recipients who could avoid extensive SAP based on the presence or absence of these risk factors.

MATERIAL AND METHODS

Kidney transplant data collection

262 KTx were performed at the Department of General and Transplantation Surgery, Warsaw Medical University, between January 2010 and December 2011. Kidneys procured from living related donors were excluded from further analysis and accounted for 8.4% (22/262). Deceased donors (DDs) represented 91.6% of the total (240/262). From DDs, 220 kidneys were maintained in LifePort (Organ Recovery, Itasca, IL, USA) or MOX-100 (Waters Instruments, Rochester, MN, USA) machine perfusion prior to the transplantation. The other 20 kidneys from DDs, stored in simple hypothermia, were excluded from the observation. Records from the 220 allograft recipients were analyzed, and we determined the incidence of UTI in these patients during the first month after transplantation (early UTI).

We retrospectively, collected demographic and clinical data for the 220 patients, including age, gender, cause and duration of end-stage renal disease, comorbidities, and intraoperative plus post-transplantation parameters. We also considered donor sources (extended criteria donor (ECD) or standard criteria donor), body mass index, the donor’s cause of death, length of stay in the intensive care unit, positive microbiological cultures from the donors, perfusion parameters, and surgical procedure information, such as total duration and cold ischemic time. Additionally, all UTIs detected at our center were nosocomial, as it is required for the kidney recipients to be free from any urinary infection before transplantation. All recipients, prior to being placed on the waiting list for Tx must have three sterile urine cultures.

Immunosuppression protocol

Immunosupresion therapy was based on three-drug protocol, during one-year follow up period - calcineurin inhibitors (tacrolimus or cyclosporine) combined with prednisolone and mycophenolate mofetil or mycophenolate sodium. Tacrolimus or cyclosporine was administered at 0.2 mg/kg or 10 mg/kg per day, respectively, starting with a half-dose on the day
of transplantation with individually-adjusted doses based on tested blood levels. Mycophenolate mofetil or mycophenolate sodium were administered twice a day in 1.0g or 720mg doses. Intravenous prednisolone was given on the day of surgery: 250 mg during anastomoses and 125 mg over 12-24 h. Twenty milligrams prednisolone was given orally on the third post-operative day, followed by a decrease to 10-15 mg by the end of the month and 5 mg by the end of the year. Induction immunosuppression (basiliximab or thymoglobulin) was administered in cases of second transplantation, PRA (Panel Reactive Antibody) above 20%, 4 or more mismatches.

Surgical methods

Transplantation procedures were performed using standardized techniques. All recipients had their hair removed from the surgical field with a razor. Before placing a Foley catheter into the bladder, the recipient’s skin was prepared using an Octenisept solution (Octenidine dihydrochlorid 0.1g, 2-Phenoxethanol 2.0g). The kidney graft was placed retroperitoneally in the iliac fossa and the ureter was anastomosed to the recipient’s bladder using the Lish-Gregoir or MacKinnon techniques, depending on the surgeon’s preference. A double-J catheter was not routinely placed.

Standard antibiotic prophylaxis (SAP)

Depending on their daily diuresis (<1 L/day or >1 L/day), patients received a dose of 1.0g or 2.0g ceftriaxone prophylactic antibiotic, respectively, within 30 min prior to transplantation. This therapy was continued for another 72 h, but then discontinued if decreasing white blood cell and C-reactive protein levels were observed and no signs of inflammation present, as well as no other complications such as hematoma, lymphocele, or urinary leakage. Increasing the dosage or duration of antibiotic therapy was considered post-operatively when signs of infection were detected. To prevent Pneumocystis iiroveci infection, trimethoprim-sulfamethoxazole was administrated (480mg/day) beginning on the fourth post-operative day, continued for another 72 h, but then discontinued if decreasing white blood cell and C-reactive protein levels were observed and no signs of inflammation present.

Statistical Analysis

Chi-square or Fisher’s exact tests were used to compare categorical variables of the two patient groups. For testing differences between means or medians, student’s t-tests or Wilcoxon tests were applied, respectively. A critical level for hypothesis testing was set at 0.05. The statistical software, used for analysis, was Statistica 10.0 (Statsoft, Tulsa, OK, USA).

RESULTS

Microbiological analyses were performed by the Department of Medical Microbiology at Warsaw Medical University. Isolated strains were identified and characterized by standard microbiological methods. Specifically, the specimens were cultured under aerobic conditions at 35-37°C for 24-48 h using commercially available blood agar (Difco, Detroit, MI, USA) and MacConkey agar media (bioMérieux, Marcy l’Etoile, France). Moreover, Sabouraud’s agar (Difco) was used for fungal cultivation. The biochemical characteristics of cultured strains were investigated using VitekII (bioMérieux) according to the manufacturer’s instructions. Antimicrobial susceptibility testing of pathogenic strains was performed using the VitekII system (bioMérieux), and disc-diffusion method, according to recommendations of the European Committee on Antimicrobial Susceptibility Testing (EUCAST) (10). Additional tests were performed to identify the specific mechanisms of resistance in the case of multi-drug resistant (MDR) strains. The additional tests included checking the capability of production of ESBLs (extended spectrum beta-lactamases) and/or EMBLs (metallo-beta lactamases) by Gram-negative bacteria and, in the case of enterococci, the susceptibility to high concentrations of gentamicin and streptomycin were examined. All tests were performed and interpreted according to EUCAST recommendations (10).
were male and the average age of the recipients was 47.6 ± 14.5. UTIs were detected in 55 patients (25%). The remaining patients (n=165) were defined as the control group. Demographic and clinical data are presented in Table 1.

Recipient-related factor analysis

Patients in the UTI group did not differ from the control group with respect to age, immunosuppression protocol (as all recipients received treatment according to one regimen), or cardiovascular co-morbidities (Table 1). The occurrence of new-onset diabetes after transplant (NODAT) was significantly higher in the UTI cohort (8/55, 14.5%) than in the control group (7/165, 4.2%; p<0.05). The development of urological complications resulting in instrumental manipulation or surgical intervention in the urinary tract was significantly more frequent (p<0.05) in the UTI group (5/55, 9%) than in the control group (2/165, 1.2%). Mean recipient body mass index (BMI) was higher in the UTI group (24.7 ± 3.5 kg/m²) than in the control group (24.3 ± 3.7 kg/m²), but the difference was not statistically significant (p=0.41). BMI was not a risk factor for UTI. Human leukocyte antigen (HLA) compatibility was an independent risk factor for the development of UTIs, as recipients with more than four HLA mismatches were more likely to develop a UTI (18/55, 32.7%, in the UTI group vs. 29/165, 17.5%, in the control group; p<0.05). There was no statistical difference in immunosuppression therapy between the groups. Induction therapy was given in 29.6% (49/165) of patients in control group and 29% (16/55) in UTI Group (p=0.71).

The occurrence of DGF strongly correlated with the UTI incidence. DGF was observed in 34 of 55 patients (61.8%) with UTIs, in comparison to 35 of 165 control patients (21%; p<0.05). In this study DGF was estimated as a risk factor for UTI. As a factor which can not be taken under consideration in perioperative assessment, we can assume that lack of IGF can be detected early postoperatively and identified as DGF. According to this data, lack of immediate graft function may be considered a perioperative risk factor for UTI.

Microbiological analyses

From all recipients, urine samples were taken if any symptom of UTI presented. Isolation of at least one pathogenic microorganism was confirmed in 32 of 55 UTI episodes and 16 strains of nine bacterial species were identified (four Gram-positive and 12 Gram-negative; Table 2). Most of the identified pathogens (13/16, 81.25%) were resistant to at least one antibiotic and considered to be an alert strain (Table 2). Escherichia coli and Klebsiella pneumoniae were the most common clinical isolates in the patients with UTI as they were identified in nine (28.1%) and five (15.6%) cases, respectively. More than 95% of those strains (92% of E. coli and 100% of K. pneumoniae) were extended spectrum β-lactamase producers (ESBL+), moreover ESBL+ strains from all Gram-negative bacteria were diagnosed in 18 of the 24 (75%) cases. None of the obtained strains produced KPC (Klebsiella pneumoniae carbapenemase) or MBL (metallo-beta-lactamase).

Enterococci were identified in 8 (25%) cases and five (62.5%) of them were resistant to glycopeptides (vancomycin-resistant enterococci, VRE). Also 5 strains were identified as a high-level resistance to aminoglycosides (HLAR).

Donor-related factor analysis

The study collected 125 DD transplants, of which 115 involved both kidneys from DDs. Five kidneys were transferred to other centers and excluded from research. In two cases, kidneys as transplanted together with the pancreas, were not taken into account and further analysis. In other two cases, due to histopathological irregularities and poor perfusion parameters, the kidneys were discarded. In one case, only one kidney was available for transplantation. Kidneys from 109 DDs were received by recipients in the control group while in the UTI group recipients received kidneys from 47 DDs. The ECDs percentage was significantly higher (p<0.05) in the UTI group (21/147, 47.4%) than in the control group (32/109, 27.8%). The analysis of donor-related factors shows that there are no statistically significant differences with relation to donor’s creatinine levels, occurrence of hypertension, age or length of stay in the intensive care unit between the UTI and control groups (Table 3).

Surgical procedure and perfusion analysis

Mean transplantation time was significantly higher in the UTI group (192 ± 62 min) than in the control group (172 ± 46 min; p<0.05). Time of transplantation was ≥ 200 min in 21 of 55 UTI patients (38.1%), but only in 33 of 165 control patients (20.0%; p<0.01). Flow differences during the fourth hour of machine perfusion (greater than or less than 120 ml/min) in both groups were also statistically significant. Mean flow was higher in the control group (128 ± 40.67 ml/min) than in the UTI group (111 ± 31.06 ml/min). Mean flow was less than 120 ml/min in 38 of 55 recipients with UTI (69%) compared to 84 of 165 control recipients (51%; p<0.05).

Analysis of perioperative independent risk factors for UTI

Independent perioperative risk factors for UTI included ECD-related transplants, lower flow in the fourth hour of machine perfusion (<120 ml/min), HLA compatibility (>4 mismatches), time of surgical procedure (>200 min), and the occurrence of DGF (which we can be interpreted as lack of IGF). Forty-eight of 220 patients (20.1%) did not have any of the
risk factors (Group 1); 118 (53.6%) had one or two risk factors (Group 2); and 60 (26.3%) of patients had three or more risk factors (Group 3). UTI occurred in 4% (2/48), 24% (28/118) and 45% (24/54) of patients in Group 1, 2, and 3, respectively (Fig. 1).

Hospital Stay

Also a correlation (p=0.01) between UTI occurrence and length of hospital stay was observed. Patients who had an early infection (within the first month after transplantation) experienced a longer hospital stay (28 days) compared to patients without infection (15 days).

One year graft and patient survival

We analyzed the impact of UTI on renal function during the following periods: 7, 14, 30, 90,180, and 360 days after transplantation. We evaluated annual graft and patient survival, as well as renal function based on serum creatinine at certain intervals (Table 4). Annually, all (UTI + nonUTI) patients' survival rate was 98%, with 90% graft survival. Patients survival in the group where UTI was not detected was more than 99% (± 8), and 95% (± 2) in recipients with UTI during the first month post transplant (p=0.2). During the first six months post-transplantation, we observed a statistically significant difference in the rate of decrease in serum creatinine between patients with or without UTIs. However, after 360 days post-transplant, this statistical significance no longer existed. The one-year graft survival rates in the UTI group vs. the control group were not statistically different (p=0.2) and were respectively 87% ± 34 vs. 94% ± 24. (Fig.2)

DISCUSSION

After cardiovascular events (28), infections, are one of the leading causes of mortality after kidney transplantation (13,17). Optimizing immunosuppression, introduction of new drugs with principles of prevention treatment and surgical techniques reduces the number of infection-related complications. Nevertheless, infection still remains a serious threat. According to many sources, incidence of UTI after KTx decreases time-dependently and most of episodes occur in the early posttransplantation period, with a high incidence of recurrence. Vidal et al. observed UTI in 36.55% of recipients (5), in Vero- ux's 1-month-observation, 20% of kidney recipients suffered from UTI (14). Downward trend in the number of UTI complications with time can be also found in Ariza-Heredia’s study (6). It is clear that UTIs prophylaxis and optimal prevention is essential from the very beginning of kidney transplantation procedure. Numerous papers describe a variety of risk factors for urinary tract infection. Several can be definitely associated with donor, recipient (DGF, age) or connected with individual center regimens in treatment (duration of bladder catheterization, especially when >7 days, presence of ureteric stent, immunosuppression regimen) (5,10,22). Ariza – Heredia also included presence of urological abnormalities, namely: comorbidity- benign prostatic hypertrophy, ureteral obstruction, bladder dysfunction, urinary incontinence or vesicoureteral reflux, and also female gender, which for some is one of the strongest risk factors (10,23-25). Other studies did not confirm those conclusions (29).

Identification of a group of recipients in which SAP could be safely avoided is very problematic. However, we observed a significant correlation between UTI incidence and longer procedure time, possibly due to the patients’ increased exposure during surgery to microbes involved in post-operative infections. Donor status also played a significant role in the occurrence of UTIs. Due to wider acceptance of organs from ECD (30), patients more frequently developed UTIs, which likely leads to DGF (and lack of IGF) in these kidneys. Our findings confirm previous results that show a significant relationship between DGF and the development of UTI (7-11). Patients who developed NODAT were more likely to develop a UTI than non-diabetic patients, possibly due to all problems and “challenges” in glycemic control that appear after renal transplantation (9). But that factor, as well as the possible urological complications can be assessed only in the posttransplantation period. Correlation with the type of immunosuppression treatment and occurrence of UTIs was not present. This is probably because in most patients immunosuppression procedures are very consistent, and proliferative signal inhibitors - drugs reported to promote UTI, are not used during the initial post-operative period (11,15). These drugs are only introduced after one month post-transplantation, if necessary. Also two recent observations in a large group of recipients investigated particular types of immunosuppression protocols used in particular centers. Both brought the authors to the conclusion, that neither immunosuppression therapy, the maintenance of corticosteroid therapy versus early cessation, nor type of induction of immunosuppression therapy (ATG vs. Basiliximab) are independent risk factors for UTI (5,10). Also hypertension and ischemic heart disease, as recipient co-morbidities, did not influence UTI occurrence.

In our patients, the rate of urinary tract infection during the first month post-transplantation was only 25%, while rates reported from other centers vary from 20% to 47% (5,6,10,17-20). All that leads us to the conclusion of correctness in the pursuit of procedures implemented at our institution to protect patients from UTI. The differences in these UTI incidence rates may be explained by the use of different SAP protocols, the specific antibiotic susceptibility profiles of UTI-associated pathogens in our patients, and discrepancies in the criteria adopted for UTI diagnosis.

Over 50% of the pathogens identified in our pa-
Patients were classified as MDR, and these pathogens negatively impact the course of treatment, what leads to the conclusion that minimal SAP is evidently essential. According to previous reports, SAP which is provided shorter than 48 h seems to be safe and does not lead to higher UTI occurrence (9). In this study we would like to encourage to minimize SAP in patients with no perioperative UTI risk factors identified in our research, as we also know that complete cessation of prophylactic treatment and current medical practice can be too revolutionary. Although our procedures in antibiotic prophylaxis were identical, the presence of UTI must have been associated with particular risk factor/s. And this is our proposition and hope for the future, to provide “gentler” SAP for those recipients where probability of UTI is lower and adjust more “alert” procedures for those with higher possibility of UTI. If there is lower possibility of UTI occurrence, we may assume that prolonged SAP could be easily avoided. Closer surveillance for those with more potential risk factors could be introduced. Low risk factor patients may benefit from a single dose of prophylactic antibiotics that could provide them with post-operative protection, but also discourage MDR pathogen colonization. Each center should adjust the type of SAP to target pathogens, which are most frequently isolated locally. In some cases, if there are no additional signs of infection, such as fever, inflammation, or elevation of C-reactive protein, antibiotic treatment may be suspended until a positive urine culture is detected.

Another the tendency we observed in our study seems crucial. Recipients without UTIs during the first post-operative month initially experienced a faster decrease in serum creatinine levels (p<0.05), but by the end of the first post-operative year, this difference was no longer statistically significant. Although the occurrence of UTIs did not appear to significantly affect graft function or survival after one year post-transplantation, patients with UTIs did experience significantly longer hospital stays compared to recipients without UTIs. This extended stay generates excessive cost and exposes patients to further infections or complications that could be avoided if UTI risk factors were identified pre-transplantation and the SAP regimen adjusted appropriately.

**CONCLUSIONS**

In summary, we decided to focus on the risk factors that were independently associated with perioperative UTI development. These included: ECD-related donation, lower flow in the fourth hour of machine perfusion (<120 ml/min), donor-recipient HLA compatibility (>4 mismatches), surgical procedure time (>200 min), and the occurrence of DGF (construed as failure in obtaining IGF), NODAT, and urological complications after transplantation also turned out to be risk factor for UTI in the post-transplantation period. As a result, hospital stay was significantly longer in patients with UTIs compared to patients with no diagnosed UTI.

Additional multi-center research is essential to assess if prophylactic antibiotic treatment may be unnecessary and even devastating in specific cohorts of kidney transplant patients by promoting MDR infections.

**ACKNOWLEDGEMENTS**

Work supported by a grant from Foundation for Research and Science Development, Poland (www.fundacja-birm.pl)

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MEDtube Science Vol.II (3); 22-29.

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Fig. 2. The one-year graft survival rates

**FIG. 1. RISK FACTORS FOR OCCURRENCE OF UTI**

Figure shows relation between UTI, dependent on number of risk factors of the individual patient. UTI occurred in 4% (2/48), 24% (28/118) and 45% (24/54) of patients in group 1 (0 risk factors), 2 (1-2 risk factors) and 3 (3 and more risk factors) respectively.

**FIG. 2. THE ONE-YEAR GRAFT SURVIVAL RATES**

UTI group vs. the control group were not statistically different (p=0.2)

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**TAB. 1. RECIPIENT FACTORS RELATED TO THE DEVELOPMENT OF UTI**

<table>
<thead>
<tr>
<th>Recipient factors</th>
<th>Control group (n=165)</th>
<th>UTI group (n=55)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td>47 ± 14.3</td>
<td>49.5 ± 15.5</td>
<td>0.28</td>
</tr>
<tr>
<td>% male</td>
<td>61.8% (102/165)</td>
<td>61.8% (34/55)</td>
<td>0.68</td>
</tr>
<tr>
<td>Body mass index (kg/m2)</td>
<td>24.29 ± 3.7</td>
<td>24.8 ± 3.4</td>
<td>0.41</td>
</tr>
<tr>
<td>HLA mismatches &gt; 4</td>
<td>17.5% (25/165)</td>
<td>32.7% (18/55)</td>
<td>0.03</td>
</tr>
<tr>
<td>Flow in fourth hour of mechanical</td>
<td>128 ± 40.67</td>
<td>111 ± 31.06</td>
<td>0.002</td>
</tr>
<tr>
<td>perfusion (ml/min)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% DGF</td>
<td>21% (35/165)</td>
<td>61.8% (34/55)</td>
<td>0.0005</td>
</tr>
<tr>
<td>% type of dialysis (HD)</td>
<td>92% (152/165)</td>
<td>93% (51/55)</td>
<td>0.72</td>
</tr>
<tr>
<td>% NODAT</td>
<td>4.2% (7/165)</td>
<td>14.5% (8/55)</td>
<td>0.046</td>
</tr>
<tr>
<td>% hypertension</td>
<td>86% (142/165)</td>
<td>80% (44/55)</td>
<td>0.3</td>
</tr>
<tr>
<td>% ischemic heart disease</td>
<td>14% (23/165)</td>
<td>9% (5/55)</td>
<td>0.32</td>
</tr>
<tr>
<td>Urologic complications</td>
<td>1.2% (2/165)</td>
<td>9% (5/55)</td>
<td>0.04</td>
</tr>
<tr>
<td>Surgery time (min)</td>
<td>172 ± 46</td>
<td>192 ± 62</td>
<td>0.045</td>
</tr>
<tr>
<td>Operation time &gt;200 min</td>
<td>20% (33/165)</td>
<td>38.19% (21/55)</td>
<td>0.019</td>
</tr>
</tbody>
</table>

**TAB. 2. PATHOGENS IDENTIFIED FROM UTIS**

<table>
<thead>
<tr>
<th>Bacterial species and more important mechanisms of resistance</th>
<th>Frequency (Number of strains)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Escherichia coli ESBL (+)</strong></td>
<td>8</td>
</tr>
<tr>
<td><strong>Escherichia coli ESBL (-)</strong>**</td>
<td>1</td>
</tr>
<tr>
<td><strong>Enterobacter cloacae complex Amp C (+)</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Enterobacter cloacae ESBL (+), Amp C (+)</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Enterobacter cloacae complex ESBL (+)</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Enterobacter gergoviae</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Klebsiella pneumoniae ESBL (+)</strong></td>
<td>5</td>
</tr>
<tr>
<td><strong>Proteus mirabilis ESBL (+)</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Serratia marcescens ESBL (-)</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Serratia marcescens ESBL (+), MBL (-)</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Acinetobacter lwoffii MBL (-)</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Pseudomonas aeruginosa</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Enterococcus faecium HLAR VRE</strong></td>
<td>4</td>
</tr>
<tr>
<td><strong>Enterococcus faecium HLAR</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Enterococcus faecium VRE</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Enterococcus faecium</strong></td>
<td>2</td>
</tr>
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**TAB. 3. DECEASED DONOR ANALYSIS**

<table>
<thead>
<tr>
<th>Deceased donor factors</th>
<th>Control group (n=109)</th>
<th>UTI group (n=47)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>% age</td>
<td>44.4 ± 154</td>
<td>50.6 ± 153</td>
<td>0.01</td>
</tr>
<tr>
<td>% ECDs</td>
<td>27.8% (32/109)</td>
<td>47.4% (21/47)</td>
<td>0.01</td>
</tr>
<tr>
<td>Intensive care unit stay (days)</td>
<td>4.55 ± 2.6</td>
<td>4.7 ± 2.9</td>
<td>0.75</td>
</tr>
<tr>
<td>Creatinine level (mg/dl)</td>
<td>1.89 ± 1.46</td>
<td>1.65 ± 1.38</td>
<td>0.27</td>
</tr>
<tr>
<td>% Hypertension</td>
<td>22% (24/109)</td>
<td>31% (15/47)</td>
<td>0.22</td>
</tr>
</tbody>
</table>

**TAB. 4. SERUM CREATININE (MG/DL) OF RECIPIENTS AFTER TRANSPLANT (TX)**

<table>
<thead>
<tr>
<th>Days after Tx</th>
<th>Control group (n=165)</th>
<th>UTI group (n=55)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>3.38 ± 2.29</td>
<td>5.83 ± 3.41</td>
<td>0.01</td>
</tr>
<tr>
<td>14</td>
<td>2.28 ± 1.63</td>
<td>3.49 ± 1.92</td>
<td>0.015</td>
</tr>
<tr>
<td>30</td>
<td>1.89 ± 1.23</td>
<td>2.29 ± 1.05</td>
<td>0.019</td>
</tr>
<tr>
<td>90</td>
<td>1.66 ± 0.81</td>
<td>2.04 ± 1.03</td>
<td>0.024</td>
</tr>
<tr>
<td>180</td>
<td>1.62 ± 0.94</td>
<td>2.00 ± 1.00</td>
<td>0.033</td>
</tr>
<tr>
<td>360</td>
<td>1.67 ± 0.93</td>
<td>1.93 ± 0.93</td>
<td>0.144</td>
</tr>
</tbody>
</table>

**BIBLIOGRAPHY**

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