

## Expanding the Donor Pool – Preliminary Outcome of Kidney Recipients from Infected Donors

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**Background:** The number of cadaver donors is far beyond demand. The use of marginal donors may increase the number of organs available for transplantation.

**Methods:** We expanded our criteria for cadaver donors to include those with active infections. From January 2004 through August 2005, there were 25 cadaveric transplantations in our center. Infected donors accounted for 13 transplants and the remaining 12 that were not infected were used as the control subjects. Blood and infected locus cultures were performed before transplantation and the recipients were treated accordingly.

**Results:** There were no statistically significant differences between post-transplantation creatinine levels of the kidneys from infected and non-infected donors at 1 month ( $1.50 \pm 0.61$  vs  $2.21 \pm 0.77$ ,  $p = 0.235$ ) and 3 months ( $1.33 \pm 0.57$  vs  $2.31 \pm 0.92$ ,  $p = 0.311$ ) after transplantation. There were no differences in final creatinine levels ( $1.25 \pm 0.39$  vs  $1.81 \pm 0.89$ ,  $p = 0.077$ ), urinalysis white blood cell count ( $11.62 \pm 26.64$  vs  $1.91 \pm 3.30$ ,  $p = 0.102$ ) and blood white cell count ( $7677 \pm 1890$  vs  $8636 \pm 2390$ ,  $p = 0.635$ ). None of the recipients in the infected donor group developed systemic infections or complications. Graft and patient survival rates were both 100%.

**Conclusions:** Our results seem to suggest that kidneys procured from infected donors might be suitable for transplantation without transmission of the infective organism. Nevertheless, prophylactic antibiotics, close monitoring for possible infection and great care are warranted to prevent related complications. However, longer follow-up periods are needed.

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**Key words:** kidney transplantation, infection, marginal donor

The number of cadaver donors available is far beyond the demand. Many researchers have reported their efforts to expand the criteria for marginal donors in order to solve the donor organ shortage.<sup>(1,2)</sup> Usually we discard the kidneys from infected donors to prevent infections and death in the immunosuppressed recipients. However, recently the

use of infected donors has been shown to be successful without transmission of the pathogens when the recipients are under adequate antibiotic therapy.<sup>(4-20)</sup> We retrospectively report our preliminary results on kidney recipients from donors who were diagnosed with active infections prior to organ procurement.

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## METHODS

From January 2004 through August 2005, 25 cadaveric renal transplantations were performed at our center. We expanded our criteria for cadaver donors to include those with active infections, which were proven using results of positive culture or urinalysis. Blood and infected focus cultures were obtained and donors were treated with proper antibiotics accordingly. In the absence of infection progression, which were confirmed by improved blood white cell counts and/or urinalysis during the follow-up period, seven infected donors were included and 13 renal transplantations were performed. All of the recipients were informed of the donor status and agreed to receive the matched kidney. During the same period, 12 non-infected cadaveric transplantations were used as the control group. The immunosuppressive regimens were the same in both groups, including calcineurin inhibitor, mycophenolate mofetil and steroids. We analyzed the graft functions, presence of infections, survival rates and complication rates using t-test and multivariate analysis.

## RESULTS

All kidneys procured from the seven infected donors were transplanted to 13 recipients (including one pediatric en bloc transplantation). The infections were identified in the urinary tract in five (71.4%), respiratory tract in three (42.9%) and blood stream in one (14.3%) (Table 1). All of the recipients in the infected group were treated with antibiotics according to their culture results during the pre-transplantation period. First-generation cephalosporins were

given to those with *E. coli* urinary tract infections and third generation cephalosporins were given to other three. Vancomycin was given to those infected with oxacillin-resistant *Staphylococcus aureus* (ORSA). All donors showed improved blood white cell counts and/or urinalysis during the follow-up laboratory exams. The mean follow-up time was 11.4 months for the infected group and 10 months for non-infected group, and the patient survival rates were 100% for both groups. The graft survival rate was 100% in the infected group and 91.7% in non-infected group. There were no statistically significant differences between the post-transplantation creatinine levels of kidneys from the infected and non-infected donors at 1 month ( $1.50 \pm 0.61$  vs  $2.21 \pm 0.77$ ,  $p = 0.235$ ) and 3 months ( $1.33 \pm 0.57$  vs  $2.3 \pm 0.52$ ,  $p = 0.311$ ) after the transplantations. There were no significant differences in final creatinine levels ( $1.25 \pm 0.39$  vs  $1.81 \pm 0.89$ ,  $p = 0.077$ ), urinalysis white cell counts ( $11.62 \pm 26.64$  vs  $1.91 \pm 3.30$ ,  $p = 0.102$ ) and blood white cell counts ( $7677 \pm 1890$  vs  $8636 \pm 2390$ ,  $p = 0.635$ ) between the two groups. None of the recipients in the infected group developed infections that showed up in the routine urine, sputum and blood cultures. The multivariate analysis, after adjusting for the different calcineurin inhibitors used, the number of mismatches and the use of interleukin-2 receptor antibodies, showed no significant differences in the graft functions and infection rates between the infected and non-infected groups.

## DISCUSSIONS

Bacterial and fungal infections may be present in 60% potential cadaveric donors.<sup>(2)</sup> We used to dis-

**Table 1.** Data of Infected Donors

	Serum WBC	Band	Final Cr	Urine culture	Blood culture	Sputum culture
1	15800/mm <sup>3</sup>	3%	1.0 mg %	<i>E. coli</i>	–	–
2	16500/mm <sup>3</sup>	1%	1.8 mg %	<i>E. coli</i>	–	–
3	8700/mm <sup>3</sup>	0%	1.3 mg %	<i>Candida</i>	–	<i>Pseudomonas</i>
4	10800/mm <sup>3</sup>	3%	0.6 mg %	–	ORSA	–
5	10300/mm <sup>3</sup>	0%	4.4 mg %	<i>E. coli</i>	–	<i>H. influenza</i>
6	12200/mm <sup>3</sup>	1%	1.3 mg %	–	–	ORSA
7	12000/mm <sup>3</sup>	4%	0.5 mg %	<i>Stenotro</i>	–	–

**Abbreviations:** WBC: white blood cell; Cr: creatinine; ORSA: oxacillin resistant *Staphylococcus aureus*.

card these kidneys to prevent transmission of pathogens to the immunosuppressed recipients. Kidney transplantations from donors with positive urines culture has been reported since 1984.<sup>(3)</sup> In addition, successful transplantations from donors with bacteremia and meningitis have been reported in recent years.<sup>(4-20)</sup> Since the number of reports of successful results using transplantations from infected donors has increased, we started to transplantations from infected donors in January 2004. These donors were treated with proper antibiotics and urine, sputum and blood cultures were obtained. We closely followed the urinalysis and blood white count data to ensure that no progression of the infections was present before organ procurement. Vancomycin was added to the organ-preserving solution for those with ORSA bacteremic kidneys in order to enhance the antibacterial effects. The standard prophylactic antibiotics for kidney recipients in our institute included ampicillin, amikin and oxacillin. We used vancomycin to replace oxacillin in recipients receiving ORSA bacteremic kidneys. First generation cephalosporins were kept as maintenance drugs during the first week after transplantation in both the infected and non-infected groups. The immunosuppression regimens were the same in the two groups. The initial results are encouraging, with similar graft functions as the non-infected group without evidence of infections or related complications. In order to adjust the possible immune-modulation effects of the different calcineurin inhibitors used, the number of mismatches and the use of interleukin-2 receptor antibodies, we used a multivariate analysis to adjust for these factors. The results showed no significant differences in graft functions and number of infections between the infected and non-infected groups. However, the power of this multivariate study was limited due to insufficient number of cases. We need to enroll more cases to demonstrate the statistical significance better. The 100% patient and graft survival rates at 1 year of follow up are comparable to other series.<sup>(10,11,13)</sup> Two patients were re-admitted after discharge from the hospital. One was admitted due to herpes zoster and the other due to cytomegalovirus (CMV) syndrome, who already had the CMV antibody before transplantation. Both patients had improved within a few days after beginning the antiviral treatment and were discharged smoothly with stable graft function. Our

preliminary experiences seem to suggest that the kidneys procured from infected donors might be suitable for transplantation without transmission of the infective organism. Proper antibiotic therapy should be given according to the cultures obtained from the donors. However, we need longer follow-up periods and larger numbers of cases to confirm the long-term results.

### Conclusions

Using aggressive antibiotics treatment of infected donors, more cadaveric donors can be used as a source for organ transplantation. The results in our center did not show significant differences in graft functions between the infected donor and non-infected groups without the transmission of pathogens. Nevertheless, prophylactic antibiotics, close monitoring for possible infections and meticulous care are warranted to prevent related complications. We need to conduct longer follow-up studies to establish long-term results.

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## 增加器官來源——腎臟移植自感染器官捐贈者之早期成果

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**背景：**目前器官移植需求遠大於供給，採用較寬鬆之標準可以增加器官來源。

**方法：**我們在合理的監測下確認腎臟未受感染並取得受腎者同意後，使用感染病危器官捐贈者之腎臟進行移植；自 2004 年 1 月至 2005 年 8 月共有 25 例屍腎移植，其中 13 例為來自感染獻腎者，移植前皆留有細菌培養並以相符之抗生素治療受腎者。

**結果：**移植後一個月及三個月之血清肌苷酸濃度在兩組受腎者並無顯著差異，最終血清肌酸酐濃度、尿液分析及血液白血球數量亦無差異，在感染組並未發生全身系統性感染或併發症，器官及病患存活率皆為 100%。

**結論：**在嚴謹的監測下並投予合適之抗生素，感染病危器官捐贈者之腎臟可以用於移植，移植後細心照護是必須的；我們須要更長時間追蹤以達成更確實的結論。

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**關鍵詞：**腎移植，感染，邊緣器捐者

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