Contamination of Preservation Fluid in Kidney Transplantation: Single-Center Analysis

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ABSTRACT

Introduction. Contamination of preservation fluid is common, with a reported incidence of 2.2% to 28.0%, and may be a major cause of early morbidity after transplantation. Herein, we report our experience with routine examination of preservation fluid collected just before implantation, focusing on the rate of contamination and the clinical consequences to recipients.

Materials and Methods. We analyzed 62 samples of preservation fluid for microbial and fungal contamination.

Results. Twenty-four samples (38.7%) were contaminated with at least 1 organism. Bacterial contamination alone was observed in 18 samples; all patients received prophylactic treatment with intravenous piperacillin/tazobactam, 4.5 g/d for 10 days, without clinical sequelae. Six samples were contaminated with *Candida* species; all patients received prophylactic treatment with fluconazole, 100 mg/d for 3 months. One patient developed reversible acute renal failure due to ureteral obstruction by fungus balls at 30 days after transplantation.

Conclusion. Contamination of preservation fluid occurs frequently after kidney transplantation. Bacterial contamination evolved without symptoms in most patients treated with prophylactic antibiotic therapy. Fungal contamination may be potentially life-threatening. However, graft nephrectomy is not mandatory if the involved *Candida* species is identified correctly and appropriate antifungal therapy is rapidly prescribed.

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INFECTION may be an important cause of morbidity and mortality after kidney transplantation. In kidney transplant recipients, infections may originate from a number of sources including transmission from the donor.[1,2] Contamination of the kidney may occur at various stages during the process of deceased-donor transplantation including the multiple-step procedures of multiple-organ recovery and packaging of the kidney after it has been removed from the donor. Contamination of the preservation fluid may occur in 7% to 24% of kidney transplantations.[3–8] Clinical consequences in the recipient may vary from asymptomatic infections to life-threatening conditions, with graft loss and even death. Herein, we report our experience with routine examination of preservation fluid collected just before implantation, focusing on the rate of contamination and the clinical consequences to the recipient.

MATERIALS AND METHODS

In this retrospective study, samples of preservation fluid from 62 kidney transplantation procedures performed over 2 years were sent for microbiological culturing. Samples of perfusion fluid obtained from the bag containing the kidney were collected before back-table dissection of the kidney, and were sent to the local microbiologic department for analysis. All grafts were from multiple-organ donors.

All patients with bacterial contamination of the perfusion fluid received antibiotic prophylactic treatment with a culture-appropriate drug, which was initiated immediately after transplantation and continued for a week in patients without symptoms. All patients with fungal contamination received prophylactic treatment with fluconazole, 100 mg/d, beginning immediately after transplantation and continuing for 3 months. In all patients, blood and urine were cultured, and sonography was performed every 3 days until discharge and weekly thereafter for 3 months.

RESULTS

Of 62 samples of perfusion fluid collected, 24 (38.7%) were contaminated with at least 1 organism (Table 1). Of affected patients, 22 had undergone kidney transplantation and 2 had undergone combined kidney-pancreas transplantation (Table 2). Bacterial contamination alone was observed in 18 of 24 samples; all patients received prophylactic treatment with intravenous piperacillin/tazobactam, 4.5 g/d for 10 days, without clinical sequelae. One patient with a positive urine culture for *Acinetobacter baumanni* received imipenem, 1 g/d.

Table 1. Organisms Isolated From Preservation Fluid

Organism Cultured	Incidence, No. (%)
Staphylococcus epidermidis	8 (33.3)
Staphylococcus warneri	2 (8.3)
Staphylococcus lugdunensis	1 (4.1)
Staphylococcus capitis	1 (4.1)
Staphylococcus aureus	1 (4.1)
Streptococcus milleri	1 (4.1)
Acinetobacter baumanni	1 (4.1)
Streptomyces haemoliticus	1 (4.1)
Shewanella putrefaciens	1 (4.1)
Hafnia Alvei	1 (4.1)
Candida guilliermondi	1 (4.1)
Candida albicans	1 (4.1)
C albicans + *S aureus*	1 (4.1)
C albicans + *Morganella morganii*	1 (4.1)
C albicans + *Enterococcus faecium*	1 (4.1)
C albicans + *S epidermidis*	1 (4.1)

Table 2. Baseline Characteristics in 62 Study Patients

Variable	Contaminated Fluid (n = 24)	Noncontaminated Fluid (n = 38)
Donor		
Age, mean, y	46.5	48.3
Cold ischemia time, h	14.1	13.4
Recipient		
Age, mean, y	52.4	47.9
Sex, male/female	12/12	23/15
Induction therapy		
Thymoglobulin	2	1
Basiliximab	5	8
Immunosuppression therapy		
Tacrolimus	15	28
Cyclosporine	3	4
Sirolimus	3	0
Rapamune	0	4
Everolimus	3	2
Steroids	24	38

Six patients exhibited contamination with *Candida* species; all patients received prophylactic treatment with fluconazole, 100 mg/d for 3 months. Five patients had no clinical sequelae, whereas 1 patient developed acute renal failure due to ureteral obstruction by fungus balls at 30 days after transplantation. Treatment in that patient included percutaneous nephrostomy and voriconazole, 200 mg/d, administered intravenously and via direct irrigation through the nephrostomy catheter. After 20 days, the ureteral passage was progressively restored, with gradual improvement in renal function.[8]

In recipients who received a kidney with contaminated preservation fluid, 2 grafts were lost because of venous thrombosis and visceral leishmaniasis, respectively. In the control group, 1 graft was lost because of acute vascular rejection, and 2 patients died because of acute myocardial infarction. No significant difference was observed in survival of patients (100% vs 95%; $P = .080$) or grafts (93% vs 99%; $P = .080$) between the contamination and control groups.

DISCUSSION

The increasing disparity between the number of patients awaiting kidney transplantation and organ availability has prompted most transplantation centers to accept donors with special clinical conditions, such as contaminated donors. The incidence of contaminated donors in the literature varies from 2.2% to 23.0%.[1,8–10]

Contamination of preservation fluid is probably independent of donor contamination. Possible sources of infection may include handling of the kidneys and exposure to contaminants during organ recovery, especially of multiple

organs. However, the duration of the operation alone does not seem sufficient to predict the incidence of contamination of perfusion fluid.[4] In a recent study, Wakelin et al,[4] who evaluated the incidence of contamination of fluid samples during organ procurement, observed that 23 of 51 samples (45%) were contaminated. However, the peritoneal swab obtained in 17 samples positive for perfusion fluid contamination tested negative; thus, it was concluded that donor infection did not seem to be a significant source of contamination in recipients.

Bacterial contamination of preservation fluid is common in kidney transplantation, with a reported incidence of 21.2% to 28.0%.[1–4,9–13] In most cases, they are of low virulence and do not pose significant risk of clinical sequelae because of the small amount of inoculum and use of prophylactic antibiotic therapy.[13] The 29% incidence of bacterial contamination in our experience was consistent with the literature. All recipients received prophylactic antibiotic therapy, and none developed bacteremia attributable to contaminants in the preservation fluid. These results confirm that although a high rate of graft loss and even death has been reported in earlier studies,[9,10,13] especially with gram-negative organisms and *Escherichia coli* infection, donor contamination no longer is a contraindication to transplantation if prophylactic antibiotic therapy is initiated at transplantation.

Six patients (9.6%) received kidneys with perfusion fluid contaminated with *Candida albicans.* All of them received prophylactic treatment with fluconazole for 3 months. None demonstrated signs or symptoms of fungal infection after transplantation. However, 1 patient developed a fluconazole-resistant *Candida* infection that resulted in acute kidney failure due to ureteral obstruction by a fungus ball.[8]

The incidence of graft infection with *Candida* is 1 in 1000 grafts,[5] with an estimated incidence of fungal contamination of 2% to 10% of all positive cultures.[6–8,14] A recent study by Albano et al[5] suggested that the source of candidiasis could be kidney contamination during organ recovery because of the close genetic relationship between isolates from preservation solutions in the donor and isolates from the operative site in recipients.

Currently, there are no therapeutic guidelines to prevent vascular or systemic complications of fungal infections from the donor or from contaminated preservation fluid. Most reports emphasize the need for prophylactic graft nephrectomy when preservation fluid is found to contain *Candida* species[5,7] because of the high incidence of mycotic aneurysm and the likely development of life-threatening complications. However, a policy of graft removal in these cases would lead to a large number of preventable nephrectomies. Countering this viewpoint, recent studies have reported a favorable outcome in patients treated with prophylactic antifungal therapy, which suggests that graft nephrectomy should not be proposed systematically but adopted on a case-by-case basis.[5,6,8,14]

In conclusion, contamination of perfusion fluid is common in kidney transplantation. Pretransplantation culture of preservation fluid may be useful for identification of recipients at high risk who could benefit from preemptive therapy. Most bacterial contaminations have a favorable outcome in patients who receive prophylactic antibiotic therapy. Fungal contamination may be potentially life-threatening; however, graft nephrectomy is not mandatory if the *Candida* species is correctly identified and appropriate antifungal therapy is rapidly established.

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