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Clinical Significance of Surveillance Culture in Liver Transplant Recipients

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ABSTRACT

Background. Routine microbiologic surveillance is a method of infection control, but its clinical significance in transplant recipients is not known. We analyzed microbiologic data to evaluate the influence of cultured microorganisms between the point of surveillance and infectious episodes in liver transplant recipients.

Methods. We performed surveillance culture for sputum and peritoneal fluid in liver transplant recipients from January 2009 to December 2011, at the time of transplantation (T1), 5 days (T2), and 10 days (T3) postoperatively.

Results. Of the 179 recipients, 32.9% had a positive sputum culture result and 37.4% had a positive peritoneal culture result during surveillance. In the culture surveillance of sputum, 37 organisms were isolated from 35 recipients at T1, and the most common organism was *Staphylococcus aureus* ($n = 13$). At T2, 45 organisms were isolated from 39 recipients, including *Klebsiella pneumoniae* ($n = 10$), *S aureus* ($n = 8$), and *Acinetobacter baumannii* ($n = 6$). At T3, 18 organisms were isolated from 15 patients, including *Stenotrophomonas maltophilia* ($n = 5$) and *K pneumonia* ($n = 4$). In the peritoneal fluid, 11 organisms were isolated from 10 recipients at T1, including *Pseudomonas aeruginosa* ($n = 2$) and *Enterococcus* species ($n = 2$). At T2, 39 organisms were isolated from 36 recipients, including coagulase-negative *Staphylococcus* species (CNS; $n = 8$) and *Enterococcus* species ($n = 7$). At T3, 54 organisms were isolated from 51 recipients, including CNS ($n = 17$) and *Candida* species ($n = 8$). Among the 59 patients with positive culture results for sputum surveillance, 16.9% developed pneumonia caused by the same organisms. Among the 67 patients with positive peritoneal fluid culture, 16.4% developed an intra-abdominal infection caused by the same organisms cultured. The recipients with positive surveillance culture had a higher risk of pneumonia (20.3% [12/59] vs 1.6% [2/120]; $P < .001$) and intra-abdominal infection (31.3% [21/67] vs 18.7% [21/112]; $P = .05$).

Conclusions. Periodic microbiologic surveillance may be useful in the prediction of post-transplantation pneumonia and intra-abdominal infection and could offer a potential target for empirical antimicrobial therapy in cases of infection.

DESPITE advances in surgical techniques and post-operative care, infectious complications after organ transplantation remain important risk factors for morbidity and mortality. Bacterial infection is most common among recipients of liver transplants, and is responsible for 33%–68% [1]. The most common types of infection are intra-abdominal infections, primary bacteremia, and pneumonia [2]. Studies have reported that pneumonia-related mortality after liver transplantation may be as high as 36.6%–53% [3].

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Routine microbiologic surveillance is an infection control measure. Liver transplant recipients are at increased risk of colonization with multidrug-resistant organisms because of multiple admissions, prolonged hospitalization, broad-spectrum antimicrobial use, and invasive procedures [4,5]. Methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant *Enterococcus* (VRE) colonization through active surveillance culture are associated with risk of infection [4,6]. However, data on the clinical significance of surveillance culture from sites except nasal or rectal swab, and its usefulness in liver transplant recipients, are limited. This study aimed to analyze microbiologic data to evaluate the clinical utility of surveillance culture and the influence of cultured microorganisms between the point of surveillance and infectious episodes in liver transplant recipients.

METHODS

This prospective observational study was conducted on 184 liver transplant recipients from a 1,200-bed tertiary hospital. We performed surveillance culture on sputum and peritoneal fluid samples from all liver transplant recipients from January 2009 to December 2011. Samples were taken at the time of transplantation (T1), 5 days after surgery (T2), and 10 days after surgery (T3). Sputum samples were obtained with the use of tracheal aspirate at T1 and sputum at T2 and T3. Peritoneal fluid samples were obtained from intra-abdominal fluid with the use of a drainage catheter.

Infection was defined with the use of previously reported criteria [7]. Infectious complications within 3 months after transplantation were investigated as clinical outcomes. Pneumonia was defined if patients had clinical symptoms or signs of respiratory tract infection, as well as laboratory and radiologic evidence of pneumonia. Intra-abdominal infection was defined if patients had clinical symptoms or signs of intra-abdominal infection, as well as radiologic evidence of infection that involved any organ within the abdomen or that extended beyond the viscus of origin into the peritoneal space and was associated with either abscess formation or peritonitis [8].

Statistical Analysis

Student *t* test was used to analyze continuous variables, and the χ^2 test was used for categoric variables. Results are presented as mean ± SD.

RESULTS

Five patients who had a preexisting infection were excluded, and 179 patients (126 male, 53 female) were included in the final analysis. The mean age of the patients was 50.1 ± 11.4 years. As the underlying diseases, viral hepatitis B was most prevalent (n = 101; 56.4%), followed by alcoholic liver disease (n = 31; 17.3%) and acute hepatic failure (n = 14; 7.8%). The percentage of Child C was 44.7%.

Sputum Culture Results and Their Clinical Significance

A total of 59 patients (32.9%) had positive results for sputum culture. At T1, 37 organisms were isolated from sputum samples from a total of 35 transplant recipients, and the most common organism was *S aureus* (n = 13), followed by *Klebsiella pneumonia* (n = 5), *Stenotrophomonas maltophilia* (n = 5), and *Aspergillus* species (n = 4). At T2, 45 organisms were isolated from 39 recipients, including *K pneumoniae* (n = 10), *S aureus* (n = 8), *Acinetobacter baumannii* (n = 6), and *Enterobacter* species (n = 4). At T3, 18 organisms were isolated from 15 recipients, including *S maltophilia* (n = 5), *K pneumonia* (n = 4), and *S aureus* (n = 3; Table 1). Among the 59 patients with positive results for sputum culture, 16.9% (n = 10) developed pneumonia caused by the same organisms isolated, including MRSA (n = 5), *A baumannii* (n = 3), *K pneumonia* (n = 1), and *Aspergillus fumigates* (n = 1). Recipients with positive sputum surveillance culture results experienced a higher incidence of pneumonia compared with recipients with negative sputum surveillance culture results (20.3% [12/59] vs 1.6% [2/120]; $P < .001$; Table 2). Overall mortality rate did not differ significantly between patients with positive results for sputum culture and those with negative results (13.5% [8/59] vs 8.4% [10/120]; $P = .27$). Moreover, the infection-related mortality rate did not differ significantly between the two groups (10.1% [6/59] vs 4.1% [14/112]; $P = .11$).

Peritoneal Fluid Culture Results and Their Clinical Significance

A total of 67 patients (37.4%) had positive results for peritoneal fluid culture. At T1, 11 organisms were isolated from samples from 10 patients, including *Pseudomonas aeruginosa* (n = 2) and *Enterococcus* species (n = 2). At T2, 39 organisms were isolated from 36 recipients, including coagulase-negative *Staphylococcus* (CNS; n = 8), *Enterococcus* species (n = 7), *Candida* species (n = 7), and

Table 1. Isolated Organisms According to Surveillance Results

	Sputum			Peritoneal fluid		
	No of patients	No of organisms	Organisms	No of patients	No of organisms	Organisms
T1	35	37	*S aureus* (n = 13) *K pneumoniae* (n = 5) *S maltophilia* (n = 5) Aspergillus (n = 4)	11	10	*P aeruginosa* (n = 2) *Enterococcus* species (n = 2)
T2	39	45	*K pneumoniae* (n = 10) *S aureus* (n = 8) *A baumannii* (n = 6) *Enterobacter* species (n = 4)	36	39	CNS (n = 8) *Enterococus* species (n = 7) *Candida* species (n = 7) *P aeruginosa* (n = 3) *S aureus* (n = 3)
T3	15	18	*S maltophilia* (n = 5) *K pneumonia* (n = 4) *S aureus* (n = 3)	51	54	CNS (n = 17) *Candida* species (n = 8) *A baumannii* (n = 7) *Enterobacter* species (n = 5) *S aureus* (n = 4) *S maltophilia* (n = 4)