Health Care-Related Infections in Solid Organ Transplants

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The health care-related infections are well-known in a critical care setting, but reports of those infections in solid organ transplanted patients are scarce. We developed a study of retrospective cohort in a tertiary teaching hospital for 14 months. Eighty-one patients underwent solid organ transplants. The global incidence of health care-related infection was 42.0%. Fifteen percent of the cases were occurrences of surgical site infections, 14.0% pneumonias, 9.0% primary blood stream infections, 4.0% urinary tract infections and 2.0% skin infection. The most prevalent etiologic agents were *K. pneumoniae* (8.6%), *P. aeruginosa* (7.4%); *A. baumannii* (5.0%) and *S. aureus* (2.5%). Mortality was 18.0%, none of then related to health care infections. The high rate of those infections, mainly surgical site infections, suggests a demand for stricter measures to prevent and control health care-related infections.

Key-Words: Transplantation, health care-related infections, immunocompromised patients, infection control.

Solid organ transplant became, in the last few decades, an uncontested therapeutic option to several terminal diseases. Advances on surgical techniques and immunosuppression allowed the carrying out of over 24,000 transplants per year, in the USA [1].

Several Brazilian medical centers perform solid organ transplants with results similar to those found in the medical literature, and the number of procedures has increased in the last decade thanks to governmental policies [2].

Despite advances in immunosuppression, prophylaxis and early diagnosis, incidence of infectious complications remain high and they have been associated with loss of graft function and increased mortality [3].

Health care-related infections have been reported as a regular complication in severely ill recipients of solid organ transplants, facilitated by the use of invasive procedures, associated diseases and immunosuppression treatment.

Bacteremia and septic shock remain important causes of mortality in solid organ recipients. In 2005, Candel et al. communicated a series of 466 bacteremia episodes in 382 recipients and 66 episodes of septic shock (14.0%) after several types of transplant recipients [4]. Singh et al. reported that 50.0% of all blood stream infections found in liver transplant recipients occur in the first month after the procedure [5], similar results were found by Rodriguez et al. among heart transplanted patients [6].

Sénéchal et al. found 6.5% incidence of surgical site infection after heart transplantation with a mortality rate of 6.7%. *Staphylococcus* species were cultured intraoperatively from the majority of the patients [7].

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Although many papers review the whole spectrum of infections in solid organ transplant recipients, few specifically emphasize the first days after the procedure and the infections related to health care.

Material and Methods

Data in this study arose from a retrospective chart review of 81 consecutive solid organs transplants (heart, liver, kidney and double kidney and pancreas) performed between January 2004 and March 2005 at São Paulo Hospital, a 700-bed tertiary teaching hospital.

The epidemiological surveillance of the health care-related infections was performed by a specific appliance of the National Nosocomial Surveillance System (NNISS) methodology [5,8]. An infection control professional diagnosed each infection according to standardized diagnosis of the Center for Disease Control and Prevention (CDC) criteria.

All infections diagnosed between the procedure and the 30-first days after the surgery have been included in this review. Patients with infections are referred as a case. A control group was obtained with transplanted patients without diagnosis of infections.

Measures of significances were assessed by a univariate analysis. Chi-square, Fischer's exact test and Wilcoxon's test were used as appropriate. A multivariable analysis (logistic regression) was performed when possible. A p value < 0.05 was considered statistically significant for all tests.

Results

During the period of study, were performed 35 double kidney and pancreas transplants (43.2%), 20 heart transplants (24.7%), 17 liver transplants (21.0%), and nine kidney transplants (11.1%). As show in Table 2, cases and controls were not different in respect to gender, age and preoperative stay. The only difference found was an expected higher surgical risk index (IRIC) score among cases ($p = 0.034$). Surgery length time in the different transplant sites are shown in Table 1.

The length of the pre-transplant period was longer in heart transplant patients than in the patients of other transplant sites (8.7 days; range 0-153 days) but the incidence of HCRI was not different among them, even when the pre-transplant period was longer than 30 days (p = 0.486) (Figure 1).

The mortality rate during the first 30 post-transplant days was 18.6% in control group and 13.6% in case group (p = 0.151), none due to infection (Table 2).

Thirty four episodes of HCRI were diagnosed among 81 recipients (global incidence of 42.0%). The incidence rate by patient of HCRI was 27.0% (34 HCRI episodes in 22 patients). Table 3 shows the spread of the infections by transplant site.

Fifteen percent of the HCRI were surgical site infections, 14.0% pneumonias, 9.0% primary bloodstream infections, 4.0% urinary tract infections and 2.0% skin infections. Surgical site infection was more common in double kidney-pancreas recipients (OR 10.5; IC 2.23-49.52; p = 0.05) and primary blood stream infections among liver recipients (OR 6.79; IC 1.06-43.36; p = 0.009).

The most prevalent etiologic agents were *K. pneumoniae* (8.6%), *P. aeruginosa* (7.4%); *A. baumannii* (5.0%) and *S. aureus (*2.5%). No significant pattern of microorganism was identified among the different solid organ recipients (Table 4).

Discussion

Despite the extensive literature about infectious complications in solid organ transplants patients, there are very few studies that emphasize on the health care-related infections.

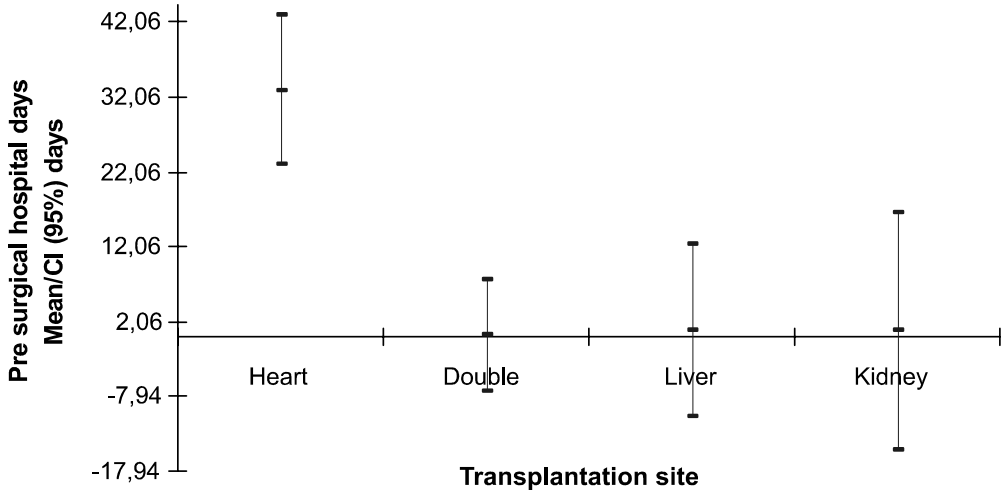
Regarding patients submitted to liver transplant, the incidence of health care-related infections in our study, by infection site, was similar to literature [9]. About the agents, there was no incidence of Gram-positive bacteria, in accordance to other reports [6].

Montoya et al. reported, in heart transplant, that main bacterial infection sites were the lungs and urinary tract [10]. In our study, however, the most observed episode of

Table 1. Surgical procedures time

Surgical procedures time	Heart	Kidney	Double kidney-pancreas	Liver	Total
< 5h	2	8	0	1	11
5h	7	0	6	0	13
6h	3	0	10	0	13
7h	1	0	11	0	12
8h	4	0	6	3	13
9h	1	0	0	4	5
> 10h	2	1	1	6	10

Figure 1. Preoperative stay by solid organ transplant site (means and 95.0% confidence interval).



+ Chi-square.

Table 2. Characteristics of cases and controls

		Case	Control	p +	OR	CI
Total (%)		22 (27.1%)	59 (72.8%)	-	-	-
Male (%)		11 (50%)	31 (52.5%)	NS	-	
Age (y)		36.1 ± 12.5 *	36.9 ±12.7*	NS	-	
Preoperative stay (%)		27.3%	40.7%	NS	-	
Mean preoperative stay (d)		8.9 ± 26.4*	2.8 ± 16.1*	NS	-	
IRIC (%)				-		
	0	1 (20.0%)	4 (80.0%)	NS		
	1	4 (12.9%)	27 (87.1%)	0.02	4.05	1.3-12.4
	2	17 (39.5%)	26 (60.5%)	0.014	3.15	1.2-8.3
Mortality (%)		3 (13.6%)	11 (18.6%)	NS		

*Standard deviation; + Chi-square; NS=not significant; OR=odds ratio/CI confidence interval (95%).

Table 3. Infection spread by transplant site

	Total	Heart N=20	Kidney N=9	Double Kidney-Pancreas N=35	Liver N=17	p value	Odds ratio	CI (95.0%)
Surgical site	12 (15%)	4 (20%)	0	7 (20%)	1 (6%)	0.009	10.5	2.23-49.52
Pneumonia	11 (14%)	3 (15%)	0	1 (3%)	7 (41%)	NS	NS	NS
Urinary tract	3 (4%)	0	1 (11%)	2 (6%)	0	NS	NS	NS
Primary bloodstream	7 (9%)	1 (5%)	0	1 (3%)	5 (29%)	0.05	6.79	1.06-43.36
Skin	1 (2%)	1 (5%)	0	0	0	NS	NS	NS
Total	34	9 (45%)	1 (11%)	11 (31%)	13 (76%)	NS	NS	NS

* Standard deviation; + Chi-square; NS=not significant; OR=odds ratio; CI confidence interval (95%).

Table 4. Microorganism spread by site of infection

	K. pneumoniae	*P. aeruginosa*	*A. baumannii*	*S. aureus*	p value
Surgical site	0	1 (25%)	1 (25%)	2 (50%)	NS
Pneumonia	3 (60%)	1 (20%)	1 (20%)	0	NS
Urinary tract	2 (66.6%)	1 (33.4%)	0	0	NS
Primary bloodstream	2 (33.3%)	2 (33.3%)	2 (33.3%)	0	NS
Total	7	5	4	2	NS

NS=not significant.

HCRI was surgical site infection (20.0%), an incidence rate higher than other studies, whose range varies from 3.5% to 6.5% [7,11].

Also, we found a long preoperative time in heart transplant recipients. Similar to literature, our terminal heart failure patients had a high rate of use of vasoactive drugs, mechanic ventricular support and indwelling catheters [12]. Unexpectedly, preoperative time was not identified as an infection risk factor.

In kidney and double kidney and pancreas transplantation, a low incidence of urinary tract infection was found, which was the most common infection complication related in the literature [11,13]. However, in the double kidney and pancreas transplantation we found, again, a high incidence of surgical site infection.

The ASA index, the potential contamination of the surgical incision, and the length of surgery may interfere on the incidence of surgical site infections. These variables are appraised separately and graded by the surgical risk index. The higher the risk Index, the greater the expected surgical site infection risk, as confirmed in our study.

Patients submitted to solid organ transplant, in general, have high ASA scores, due to comorbidities, and low potential for contamination of the surgical incision, since most surgeries are clean or only potentially contaminated.

Between all variables considered by the risk Index, the length of surgery is the hazard factor most prone to discrepancies between institutions [5]. In our study, 65.4% of the surgery procedures were longer than the NNISS recommended time, what could be explained by the fact that the institution is a teaching hospital.

As with any patient, the risk of postoperative infections increases with the length of vascular access, the length of orotracheal intubation, the presence of indwelling catheters and the presence of devitalized tissue or fluid collections [3]. Also, the degree of immunosuppression, the need to additional anti-rejection therapy, and other infections like cytomegalovirus and hepatitis C could weaken the host defenses [14].

The high rate of infection found in this study, especially surgical site infections, suggests a demand for stricter prevention measures and control of health care-related infections in the institution, mostly during the perioperatory period.

Better detailed epidemiological studies are essential for evaluating health care-related infections surveillance actions and prognosis of solid organ transplant submitted patients.

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