



Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Brief Report

A survey of infection prevention and control practices among solid organ transplantation centers

Elena Beam MD ^{a,b,*}, Raymund R. Razonable MD ^{a,b}^a Division of Infectious Diseases, Mayo Clinic, Rochester, MN^b William J von Liebig Center for Transplantation and Clinical Regeneration, Mayo Clinic, Rochester, MN

Key Words:

Solid organ transplantation

There are no standard guidelines for infection prevention and control practices among solid organ transplantation centers. To characterize the differences in infection prevention and control strategies, an electronic survey was performed in 2015 among members of American Society of Transplantation Infectious Diseases Community of Practice. These results highlight notable practice differences.

© 2018 Association for Professionals in Infection Control and Epidemiology, Inc. Published by Elsevier Inc. All rights reserved.

Infections are major causes of morbidity and mortality after solid organ transplantation (SOT) ¹⁻³. There are guidelines for antimicrobial prophylaxis, surveillance, and treatment of infections in transplant recipients. ⁴⁻⁷ However, guideline for infection prevention and control (IPAC), which are key in preventing spread of infections, have not specifically addressed the SOT populations. ^{8,9} To assess the status of IPAC practices among SOT centers, we performed this survey.

METHODS

In November 2014, an electronic survey was sent to members of the American Society of Transplantation Infectious Diseases Community of Practice (IDCoP), a group of providers with interest in SOT infections. The IDCoP consists mostly of infectious disease providers, although there is representation from surgeons, transplantation medicine specialists, and pharmacists. The IDCoP members were asked specific questions on their IPAC practices. Only 1 response per SOT program per center was considered. All responders were encouraged to seek input from their IPAC personnel. The data were analyzed using descriptive statistics.

RESULTS

A total of 35 kidney, 31 liver, 29 heart, and 24 lung transplantation centers were included in the survey. Most were academic medical centers in North America.

* Address correspondence to Elena Beam, MD, Mayo Clinic, Infectious Disease, 200 First St SW, Rochester MN 55905.

E-mail address: beam.elena@mayo.edu (E. Beam).

Kidney transplantation centers

Most transplantation centers do not provide high-efficiency particulate air (HEPA)-filtered rooms (68%) or positive-pressure rooms (77%; [Table 1](#)). For the few centers that do, HEPA-filtered and positive-pressure rooms were provided at all times (8.6% and 0%, respectively), during immediate posttransplantation hospitalization (8.6% and 8.6%) or only when clinically indicated (2.9% and 5.7%). Ten centers require transplant room doors to be closed. Most (71%) perform standard room cleaning, whereas 20% perform additional cleaning measures (including routine and terminal clean with bleach, use of bleach for rooms of patients with *Clostridium difficile*, ultraviolet light cleaning for certain rooms, or routine cleaning with environmental antiseptics such as quaternary ammonium compounds).

Almost all centers recommend standard hand hygiene. An equal proportion of centers either do not routinely use gloves or gowns (43% and 49%, respectively) or use them only when clinically indicated (46% and 48%). Most do not require patients to wear respiratory masks out of hospital rooms (66%) or at hospital dismissal (77%). Dedicated small medical equipment is provided by a majority (63%) of centers, mostly when clinically indicated.

Liver transplantation centers

A majority of 31 liver transplantation centers do not provide HEPA-filtered (68%) or positive-pressure rooms (77%; [Table 1](#)), whereas a quarter have a closed-door policy.

All but 2 centers (94%) practice standard hand hygiene. There is a similar distribution of centers that do not routinely use gloves or

Table 1
Infection prevention and control practices in abdominal transplantation centers

Infection control practice	Liver transplantation n = 31 (%)			Kidney transplantation n = 35 (%)		
	Yes	No	Not known	Yes	No	Not known
Use of HEPA-filtered rooms	19.4	67.7	12.9	20	68.5	11.4
All times	(9.7)			(8.6)		
Immediate post-transplant*	(9.7)			(8.6)		
When clinically indicated	(0)			(2.9)		
Use of positive-pressure rooms	12.9	77.4	9.7	14.3	77.1	8.6
Immediate post-transplant*	(9.7)			(8.6)		
When clinically indicated	(3.2)			(5.7)		
Use special room cleaning	22.6	74.2	3.2	20	71.4	8.6
All times	(16.1)			(14.3)		
When clinically indicated	(6.5)			(5.7)		
Doors closed at all times	22.6	71.0	6.5	28.6	65.7	5.7
All times	(0)			(2.9)		
Immediate post-transplant*	(9.7)			(8.6)		
When clinically indicated	(12.9)			(14.3)		
2 weeks posttransplant	(0)			(2.9)		
Additional hand hygiene	6.5	93.5	0	2.9	97.1	0
Isolation gown use	54.8	45.2	0	51.4	48.6	0
Immediate post-transplant*	(3.2)			(2.9)		
When clinically indicated	(51.6)			(48.6)		
Use of gloves	54.8	45.2	0	57.1	42.9	0
All times	(6.5)			(5.7)		
Immediate post-transplant*	(6.5)			(5.7)		
When clinically indicated	(41.9)			(45.7)		
Designated medical equipment use	61.3	38.7	0	62.8	37.1	0
All times	(3.2)			(8.6)		
Immediate posttransplant*	(3.2)			(2.9)		
When clinically indicated	(54.8)			(51.4)		
Masks when leaving hospital rooms	29	71	0	31.4	65.7	2.9
Immediate posttransplant*	(9.7)			(8.6)		
3 mo posttransplant	(9.7)			(11.4)		
6 mo posttransplant	(0)			(2.9)		
When clinically indicated	(6.5)			(5.7)		
During neutropenia only	(3.2)			(2.9)		
Masks required when outside of hospital	12.9	80.6	6.5	17.2	77.1	5.7
Immediate posttransplant*	(3.2)			(2.9)		
3 mo posttransplant	(6.5)			(8.6)		
6 mo posttransplant	(0)			(2.9)		
When clinically indicated	(3.2)			(2.9)		

HEPA, high-efficiency particulate air.

*During the immediate posttransplant hospitalization only

isolation gowns (45% and 45%) and those that use them do so when there are clinical indications (54% and 54%, respectively); 2 centers require providers to use gloves at all times. The majority do not routinely recommend respiratory masks when patients are out of hospital rooms (71%) or at hospital dismissal (81%). Dedicated small medical equipment is used mostly with clinical indications (55%).

Heart transplantation centers

A majority of the 29 heart transplantation centers do not routinely provide HEPA-filtered or positive-pressure rooms (66% for both) (Table 2), whereas 10% use HEPA-filtered rooms during the immediate posttransplantation period, 10% in intensive care units, and 3% when clinically indicated. Positive-pressure rooms are used at all times in 1 center, during the immediate posttransplantation period in 14%, and when clinically indicated in 10%. A third of centers have rooms with a closed-door policy. One center provides special room cleaning (but not specified).

Standard hand hygiene is recommended by most (93%) centers. One center requires the routine use of gloves, whereas almost half (45%) require glove use only when clinically indicated. Almost half (48%) recommend isolation gown use with clinical indications only. The majority (62%) provide dedicated small medical equipment, mostly when clinically indicated. The use of respiratory masks is variable (Table 2).

Lung transplantation centers

Only a minority of 24 lung centers use HEPA-filtered rooms, either immediately after transplantation (8%) or in intensive care units (8%) (Table 2). A quarter provide positive-pressure rooms. A quarter have closed-door policies. One center performs measures beyond standard room cleaning.

Most centers recommend standard hand hygiene. Only 8% recommend routine use of isolation gown and gloves, whereas almost half (46%) use them only with clinical indications. Most centers recommend respiratory masks when patients leave their hospital rooms (58%), but the duration was variable from the immediate posttransplantation period (17%) to all times (13%). A third of centers recommend that patients wear respiratory masks when they leave the hospital, for up to 6 months after transplantation.

Miscellaneous IPAC policies

Among all centers, visitor age restriction varied from <5 years to <15 years, when enforced, whereas 38% had no such policy. The majority of centers do not allow plants or flowers (65%) or animals (66%) in transplant rooms. Only some centers allowed visit from pets or service animals. The majority (69%) allowed patients to use their personal belongings (blankets, pillows) in hospital rooms.

Table 2
Infection prevention and control practices in cardiothoracic transplant centers

	Heart transplant n = 29 (%)			Lung transplant n = 24 (%)		
	Yes	No	Not known	Yes	No	Not known
Use of HEPA-filtered rooms	24.1	65.5	10.3	16.7	70.8	12.5
Immediately posttransplantation	(10.3)			(8.3)		
When clinically indicated	(3.4)			(0)		
Others*	(10.3)			(8.3)		
Use of positive-pressure rooms	27.6	65.5	6.9	25	66.6	8.3
All times	(3.4)			(4.2)		
Immediately posttransplantation	(13.8)			(12.5)		
When clinically indicated	(10.3)			(8.3)		
Use of special room cleaning	13.7	86.2	0	16.7	83.3	0
Immediately posttransplantation	(3.4)			(4.2)		
When clinically indicated	(10.3)			(12.5)		
Doors closed at all times	31	65.5	3.4	29.2	66.6	4.2
All times	(6.9)			(4.2)		
Immediately posttransplantation	(13.8)			(12.5)		
When clinically indicated	(10.3)			(12.5)		
Additional hand hygiene measures (beyond standard)	6.9	93.1		4.2	95.8	
Use of isolation gown for routine care	58.6	41.4		58.3	41.7	
Immediately posttransplantation	(6.9)			(8.3)		
When clinically indicated	(48.3)			(45.8)		
Other [†]	(3.4)			(4.2)		
Use of gloves during routine care	55.1	44.8		54.2	45.8	
All times	(3.4)			(4.2)		
Immediately posttransplantation	(3.4)			(0)		
When clinically indicated	(44.8)			(37.5)		
Other [†]	(3.4)			(4.2)		
Use of designated medical equipment during routine care	62.1	37.9		58.3	41.7	
All times	(10.3)			(4.2)		
Immediately posttransplantation	(6.9)			(8.3)		
When clinically indicated	(44.8)			(45.8)		
Respiratory mask use when leaving hospital rooms	48.3	51.7		58.3	41.7	
All times	(3.4)			(12.5)		
Immediate transplant hospitalization	(0)			(16.6)		
3 mo posttransplantation	(13.8)			(12.5)		
6 mo posttransplantation	(0)			(4.2)		
12 mo posttransplantation	(0)			(4.2)		
When clinically indicated	(3.4)			(4.2)		
Others [‡]	(3.4)			(4.2)		
Respiratory mask use required when outside of hospital	27.5	68.9	3.4	29.1	66.7	4.2
All times	(0)			(4.2)		
Immediate transplant hospitalization	(3.4)			(0)		
3 mo posttransplantation	(3.4)			(0)		
6 mo posttransplantation	(6.9)			(8.3)		
12 mo posttransplantation	(3.4)			(4.2)		
When clinically indicated	(3.4)			(4.2)		
Others [§]	(6.9)			(8.3)		

ICU, intensive care unit.

*During ICU stay, certain equipped area of hospital only.

[†]ICU stay.

[‡]During construction only.

[§]When in crowded places/med center, clinic waiting area.

DISCUSSION

This survey provides a snapshot of the current state of IPAC practices among SOT centers. Although there was almost universal agreement in the use of standard hand hygiene, there was wide variation in most other IPAC practices.

Some of the highly variable IPAC practices deserve emphasis. For example, lung transplantation centers more often recommend the use of respiratory masks, likely in an effort to protect the lung allograft from respiratory pathogens. However, the use of HEPA-filtered or positive-pressure rooms, and having a closed-door policy, was similar between lung and other SOT programs.

There was variation in methods of room cleaning. Although most appear to use only standard methods for room cleaning, a few centers provide measures beyond standard. We speculate that each center's rate of multidrug-resistant organisms, including *C difficile*, may have influenced these differences in IPAC policies. Surprisingly, there were a

number of “not known” responses, suggesting that there may not even be a specific IPAC policy or that SOT providers may not even be familiar with their institutional policies.

Our brief report, which highlights the variability in IPAC practices among SOT centers, calls for the conduct of multicenter collaboration to study specific IPAC strategies after transplantation. Such studies will need to consider seasonal variation and local and institutional differences in rates of drug-resistant pathogens including, *C difficile*, the cost and sustainability of implementation of IPAC strategies, and the expected potential benefit.

Acknowledgments

Thank you to the members of American Society of Transplantation IDCoP who participated in the survey and reviewed the questionnaire for content and clarity.

References

1. Green M. Introduction: Infections in solid organ transplantation. *Am J Transplant* 2013;13(Suppl 4):3-8.
2. Fishman JA. Infection in solid-organ transplant recipients. *N Engl J Med* 2007;357:2601-14.
3. Hamandi B, Husain S, Grootendorst P, Papadimitropoulos EA. Clinical and microbiological epidemiology of early and late infectious complications among solid-organ transplant recipients requiring hospitalization. *Transpl Int* 2016;29:1029-38.
4. Martin SI, Fishman JA. Pneumocystis pneumonia in solid organ transplantation. *Am J Transplant* 2013;13(Suppl 4):272-9.
5. Silveira FP, Kusne S. Candida infections in solid organ transplantation. *Am J Transplant* 2013;13(Suppl 4):220-7.
6. Razonable RR, Humar A. Cytomegalovirus in solid organ transplantation. *Am J Transplant* 2013;13(Suppl 4):93-106.
7. Singh N, Husain S. Aspergillosis in solid organ transplantation. *Am J Transplant* 2013;13(Suppl 4):228-41.
8. Boyce JM, Pittet D. Healthcare Infection Control Practices Advisory Committee. Society for Healthcare Epidemiology of America. Association for Professionals in Infection Control. Infectious Diseases Society of America. Hand Hygiene Task F. Guideline for hand hygiene in health-care settings: recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Infect Control Hosp Epidemiol* 2002;23:S3-40.
9. Sehulster L, Chinn RY. CDC, HICPAC. Guidelines for environmental infection control in health-care facilities. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). *MMWR Recomm Rep* 2003;52:1-42.