

Tufts Medical Center Transplantation ID Consultation Service

a) Goals, Objectives, and ACGME Competencies

Goals

- To teach ID residents the physiological basis of infectious diseases, the differential diagnosis and treatment of these diseases, and the broad array of skills required to carry out effective, timely and courteous consultation in infectious diseases.
- To become familiar with the particular infectious and noninfectious issues relevant to recipients of solid organ and bone marrow transplantation, including the diagnosis, treatment and prevention of infections. To become familiar with the specific characteristics of recipients of solid organ and bone marrow transplantation. These include underlying diseases necessitating transplantation, anatomic changes, means of immunosuppression, interactions between immunosuppressive agents and other drugs, factors specific to the donor relevant to infections in the recipient.
- To understand and identify risk factors for the development of infectious diseases in transplant recipients.
- To understand the principles of pre-transplantation screening for infectious disease, including the measurement of antibodies to toxoplasma, CMV, and other pathogens, PPD testing and vaccine administration.
- To be able to identify the broad range of infectious pathogens, opportunistic and non-opportunistic, to which recipients of transplantations are susceptible.
- To become knowledgeable in the diagnosis of infections in transplant recipients, including differentiation of infectious from noninfectious conditions, such as graft versus host disease.
- To become familiar with the indications for the initiation of treatment of infection and the specific agents used, including their toxicities and drug interactions.
- To understand the rationale behind preventive/prophylactic therapy and become familiar with its use.

Objectives

First Year ID Residents:

- To gain a basic understanding of the major diagnoses, pathophysiology, differential diagnosis, and therapy of infectious diseases encountered in patients in the peri and post-transplant setting.
- To use primary classical and recent literature in the care of patients with transplant-related infectious diseases and to transfer the experiences learned in specific instances to future experiences.
- To be able to teach principles of transplant-related infectious diseases to other health professionals, including medical students.
- To learn the art of consultation, including the discussion of the consultant's opinions with the primary care team.
- To understand the importance of discharge planning and follow-up of patients with complicated transplant-related infections.

Second Year ID Residents:

- To possess an advanced understanding of pathophysiology, differential diagnosis, and therapy and prevention of major and unusual infectious diseases encountered in the post-transplant patient.
- To regularly read and critically assess the primary infectious disease literature, become familiar with published practice guidelines and apply this knowledge to the care of those patients with transplant-related infectious diseases. Can impart sophisticated and detailed information regarding transplantation-related infectious diseases to peers and those less experienced.

Rationale/Value

A clinical rotation, conference and specific lectures concentrating on transplantation infectious diseases provide an opportunity to become immersed in the specialized problems of the non-HIV immunocompromised host. Learning is reinforced by meshing hands-on clinical experience with participation in conferences, didactic lectures, and investigation of the literature through independent and directed reading.

Most Important Educational Content

Patient Characteristics:

On the solid organ transplantation service, patients with underlying diseases such as hepatitis B, hepatitis C, alcoholic liver disease, autoimmune hepatitis, primary biliary cirrhosis, cryptogenic cirrhosis,^[BC1] polycystic kidney disease, reflux nephropathy, IgA nephropathy, medication-induced nephropathies, hypertensive and/or diabetic nephropathy and others are encountered pre- and post transplantation in formal consultation. Cadaveric and living donor transplant recipients are represented. On the heart transplantation service, patients with various forms of cardiomyopathy (ischemic and various non-ischemic cardiomyopathies), including some who require intra-aortic balloon pumps, implanted defibrillators and ventricular assist device support, are routinely encountered. On the bone marrow transplantation service, patients with a wide variety of hematologic illnesses such as acute and chronic leukemia, aplastic anemia, multiple myeloma and lymphoma are represented. The types of bone marrow transplantations performed include allogeneic full-dose or reduced dose matched related or unrelated and autologous transplantations. Graft-versus-host disease is a frequently encountered complication.

Types of Clinical Encounters:

The encounters in this curriculum component are in the form of ID consultations. ID residents review historical and laboratory material and interview and examine each patient. During rounds, the ID resident presents the patient's case, with an assessment and diagnostic and therapeutic plan to the attending physician. The attending then sees the patient with the ID resident and demonstrates points in history-taking, physical examination, synthesis and differential diagnosis and development of a cost-effective plan for tests and treatment. Hospital epidemiology principles of communicability and isolation are taught systematically in relation to specific patients. The attending physician personally reviews x-rays, ultrasound studies, radionuclide studies, pathological material, and microbiological materials, with the resident. Patients are followed daily until the infectious disease problem has resolved. The resident also has the expectation that they will teach other team members, including medical residents and medical students, on focused topics relating to infectious disease issues encountered on the service.

Occasionally, outpatients who have undergone transplantation are seen in infectious disease center by the resident and attending.

ACGME Competencies

Patient care

First Year ID residents:

- Demonstrate care that is compassionate, appropriate, and effective for the treatment of health problems related to infectious diseases and the promotion of health and prevention of infection.
- Perform detailed history and physical exam appropriate to medical, surgical, critically ill and other patient populations in searching for an infectious disease.
- Learn to evaluate complex patients in a tertiary/quaternary-care setting who often pose unique problems of complexity, and of unusual or refractory infections.

Second year ID residents:

- Demonstrate care that is compassionate, appropriate, and effective for the treatment of health problems related to infectious diseases and the promotion of health and prevention of infection, at a more sophisticated and independent level compared to first year ID residents.
- Able to formulate a focused infectious disease differential diagnosis and diagnostic and therapeutic plan.
- Able to independently and efficiently formulate a focused infectious disease differential diagnosis and diagnostic and therapeutic plan for complex tertiary-care setting patients.

Medical knowledge

First year ID residents:

- Demonstrate knowledge about established and evolving biomedical, clinical and cognate (epidemiology and socio/behavioral) sciences in the field of infectious diseases and the application of knowledge to patient care
- Demonstrate knowledge of the most prominent disease mix encountered in this experience: Fever in the immunocompromised host, fever and neutropenia, differentiation of infectious vs. noninfectious diseases, graft versus host disease, disease caused by cytomegalovirus and other herpes viruses, usual and unusual fungal infections, catheter-related infection, *Pneumocystis pneumonia* in the non-AIDS patient, antibiotic-resistant bacteria, surgical wound and intraabdominal infections, nosocomial pneumonia, interactions between antimicrobial agents and immunosuppressive agents, adverse drug reactions, vaccination of transplantation recipients, hepatitis B and C in transplantation recipients, mycobacterial disease, prevention of infections (including CMV, PJP, fungal infection, tuberculosis).
- Understand the use of empiric and specifically targeted antimicrobial therapy, including optimal timing, dose schedules and dosage adjustment
- Understand drug interactions and toxicities, efficacies of antimicrobials and use of alternative therapies

- Understand appropriate use of preventive therapies, especially antimicrobial prophylaxis and the use of vaccines.
- Recognize and differentiate unusual manifestations of common infections vs. unusual infections vs. non-infectious conditions masquerading as infections
- Demonstrate knowledge of the following:

Expertise including but not limited to the following:

- Host defense mechanisms and defects
- Patients with host defense defects due to neutropenia
- Patients with host defense defects due to leukemia, lymphoma, and other malignancies
- Epidemiology of community acquired and nosocomial infections
- Antiinfective therapy
- Clinical microbiology

Recognition, natural history, differential diagnosis, specific diagnosis and management of:

- Fever
- Upper respiratory tract infections
- Pleuropulmonary and bronchial infections
- Urinary tract infections
- Sepsis syndrome
- Cardiovascular infections
- Central nervous system infections
- Skin and soft tissue infections
- Gastrointestinal tract infections
- Intraabdominal infections
- Hepatitis A, B, C
- Bone and joint infections
- Prosthetic Device infections
- Reproductive organ infections
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- Sexually transmitted diseases
- Urinary tract infections in normal and immunocompromised hosts
- Ocular infections
- Familiarity with etiologic agents of infectious diseases
- Nosocomial infections
- Infections of specific hosts
- Surgical infections
- Infections related to trauma
- Infections in travelers
- Sepsis syndromes
- Zoonoses
- Infections in the developing world
- Infections of solid organ transplant recipients, opportunistic and other
- Infections of bone marrow transplant recipients, opportunistic and other
- Non-infectious medical problems of the solid organ and bone marrow transplant recipient

- Drug interactions between antimicrobial and immunosuppressive agents
- Drug interactions between antimicrobial and immunosuppressive agents
- Learn the following procedures related to infectious disease testing:
 - Performance and interpretation of gram stains
 - Plating, review and interpretation of cultures of bacteria, mycobacteria, fungi, viruses, rickettsiae, chlamydiae, and parasites, and interpretation of serological tests.
 - Optimal methods of specimen collection and culture
 - Diagnostics for CMV infection (culture, shell vial, DNA detection, histopathology)
 - Interpretation of drug sensitivity testing for bacteria and selected fungi, knowledge of the sensitivity and specificity of testing,
 - Use and interpretation of serologic and biomarker testing for fungal pathogens
 - Use and interpretation of tuberculin testing in immunocompromised individuals.
 - Recommendation and interpretation of diagnostic tests, including risks, benefits, sensitivity and specificity of the tests

Second year ID residents

- Advanced understanding of same

Practice-based learning

First year ID residents:

- Learn the use of primary classical and recent literature in the care of patients with infectious diseases and to transfer the experiences learned in specific instances to future experiences.
- Learn to incorporate hands-on clinical experience with learning derived from participation in conferences, didactic lectures, and investigation of the literature through independent and directed reading.

Second year ID residents

- Advanced understanding of above
- To regularly read and critically assess the primary transplant infectious disease literature, become familiar with published practice guidelines and apply this knowledge to patient care.

Interpersonal and communication skills

First year ID residents:

- Advise physicians on the optimal usage of antimicrobial agents and their monitoring
Advise proper response to suspected or diagnosed drug reactions including the use of drug desensitization
- Advise on the appropriateness of a given procedure, such as removal of central venous catheters, abscess drainage and bronchoscopy, in the context of the management or diagnosis of an infectious disease.
- Teach principles of infectious diseases to other health professionals, including medical students.
- Learn the art of consultation, including the discussion of the consultant's opinions with the primary care team.
- Discuss microbiology testing with microbiology laboratory technologists

Second year ID residents:

- Advanced understanding of above
- Able to impart sophisticated and detailed information regarding infectious diseases to peers and those less experienced.

Professionalism

First year ID residents:

- Provide courteous and timely assistance to all callers both intramural and extramural
- Complete documentation completely and in a timely fashion necessary to promote patient care and safety
- Provide expert and compassionate care to a diverse group of patients. There is an immense diversity of patients seen by the resident. They include adults who live in the immediate urban area who present with acute and chronic infectious diseases. They are of varied ethnic, linguistic, racial and socioeconomic backgrounds and ages vary from the late teens to the very aged.

Second year ID residents:

- Advanced understanding of above

Systems-based practice

First year ID residents:

- Participate in Antimicrobial Stewardship to promote conservation of antimicrobial resources, decrease risk of development of resistance, and unnecessary side effects (See II.A.3. Tufts Medical Center Antimicrobial Stewardship Service (AMT))
- Develop understanding of medical care across the spectrum of care:

- Patients are referred to Tufts Medical Center from regional, national and international areas and institutions present for care of infectious diseases or develop infectious complications of their primary problem.
- Contribute to care coordination and discharge planning efforts, including antimicrobial deescalation, change from parenteral to oral, and facilitation of follow-up particularly for complex patients and patients discharged on parenteral antimicrobial therapy. Develop understanding of cost-effective management plans for investigation and treatment.

Second year ID residents:

- Advanced understanding of above

b) Defined Methods of Teaching

Principal Teaching Methods

Formal Consultations:

Approximately 30 to 40 [BC2] formal consultations on solid organ transplantation recipients and bone marrow transplantation recipients are performed each month. The attendings within the Division of Infectious Disease who concentrate on transplantation infectious diseases staff these consultations. Apprenticeship and Socratic methods comprise the principal method of learning. Attending physicians demonstrate skills in focused history-taking, physical examination skills, synthesis of material, differential diagnosis and creation of a management plan each day. Subspecialty residents apply these methods, and refine them according to suggestions from attendings.

Case Management Conferences:

Once per week there are separate interdisciplinary case management conferences for the solid organ (liver and kidney), heart and bone marrow transplantation services attended by the infectious disease attendings and the transplantation infectious disease resident. Cases of inpatients and selected outpatients with infections or possible infections are discussed in detail, including discussions of differential diagnosis, specific pathogens, diagnostic testing and treatment. Formal consultations usually arise from this conference. Patients on whom formal consultations are performed are seen daily until there is resolution of the infectious disease. In addition, as a result of work rounds and the weekly conference, questions concerning infectious disease in transplantation recipients frequently arise which require extensive searching of the literature. The resident takes an active role in these exercises.

Intercity Clinical Case Conference:

During the weekly intercity infectious disease conference, transplantation infectious disease residents present cases of infection in transplantation recipients for discussion by the group.

The resident then presents recent published literature pertinent to the main teaching point of the case. These conferences are attended by all residents. Thus, when residents are rotating through other activities, they continue to have exposure to transplantation infectious diseases.

Didactic Series:

Formal lectures in transplantation infectious diseases including infection after bone marrow transplantation, herpes virus infection, fungal infection, pathologic diagnosis of fungal infections, and the use of antifungal therapy, are presented to the residents.

Principal Ancillary Educational Materials

Ancillary teaching materials for transplantation infectious diseases include specimen gram stains, special stains and cultures in the microbiology laboratory, pathological and cytologic specimens, and radiographic studies. These are used in conjunction with presentations in the inter-city case conference and are reviewed during teaching rounds. The conference on infections and management issues in bone marrow transplantation is accompanied by a syllabus, which contains reprints of classic and recent articles pertinent to the topics mentioned above. Didactic lectures are accompanied by slides and a written handout. Primary papers and reviews are also distributed during the lectures. In addition, ID residents have access to on-line medical literature including peer-reviewed journals and textbooks. The Division has an electronic resource center of lecture notes and slides on a shared network drive available to ID residents and attending physicians.

c) Methods of Evaluation

Methods to Evaluate Residents

Direct observation by supervising attendings with written monthly reports based on the six ACGME core competencies of patient care, medical knowledge, practice-based learning, interpersonal and communication skills, professionalism and systems-based practice, supplemented with narrative comments. Twice yearly, reports from all recent rotations are reviewed with the entire group of attending physicians. A summary report is generated and discussed with the resident by the program director. This discussion provides an opportunity for the resident to respond to criticisms and to provide feedback to the program director on the training experience at Tufts Medical Center. In addition, attending physicians are expected to provide informal verbal feedback and advice to the ID resident during the rotation.

Methods to Evaluate Program Performance

Formal evaluation of program content and impact on professional development of ID residents is carried out by the faculty annually through the Program Evaluation Committee. The ID residents formally review the program by preparing an in-depth collective report of the Tufts Medical Center rotation at the end of each program year. This is supplemented by informal "feedback"

from ID residents during the course of their rotation at Tufts Medical Center to the attending physicians and program director. A retrospective gauge of program performance is the success (pass) rate on the infectious disease subspecialty boards.

d) Strengths of Program

1. Active and growing programs in solid organ and bone marrow transplantation, translating into ready availability of clinical experience in transplantation infectious disease. In recent years, the Center has performed the highest number of heart transplant procedures in the region.
2. Consistent approaches to and teaching of transplantation infectious diseases by physicians who have chosen to concentrate in this area, including faculty who have been involved in the field for years and are national authorities on transplantation-related infectious diseases.
3. Multifaceted approach to teaching transplantation infectious diseases which serves to reinforce principles and expand involvement in transplantation infectious diseases beyond the clinical rotation.
4. Active research in progress with protocols for both solid organ and bone marrow transplantation. This ongoing research favorably affects the intellectual component of the programs and exposes residents to the latest advances and thinking in transplantation medicine.

e) Limitations of Program

A limitation identified by ID residents and faculty previously was the lack of dedicated rounding space within the hospital. These continue to be addressed at the hospital administration level.

Faculty identify a lack of resources for faculty development.

Ongoing co-ordination of during transitions of care for patients was noted as a deficiency. The program has added administrative support for patients being discharged on outpatient intravenous antibiotics (OPAT).

Challenges in the inpatient setting include maintaining a work-life balance. The program monitors the consult volume on a continual basis and distributes consults to different teams as appropriate. Additionally, Massachusetts, like the rest of the nation, struggles heavily with syndemics of opioid use disorders and infectious complications. These combine to create challenging patient populations. Efforts to give additional skills in Medication Assisted Therapy are spearheaded by Dr. Alysse Wurcel. Institutionally, Graduate Medical Education has organized numerous resources to promote wellness and work-life balance.

Infectious Diseases nationally, faces ongoing recruitment and retention issues.