Infectious Diseases and their impact on Organ Donation and Transplantation

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University of Wisconsin
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Introduction

• More patients living with transplant immune suppression every year
  • 2015 was the first year more than 30,000 transplants were performed!
• Prevalence of infection in transplant recipients
  • Now the leading cause of admission after transplant
Patient Population

Prevalence of People Living with a Functioning Transplant at End of Year
2000 to 2008

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>All Organs</td>
<td>125,577</td>
<td>134,629</td>
<td>143,543</td>
<td>151,960</td>
<td>161,215</td>
<td>170,714</td>
<td>180,036</td>
<td>195,172</td>
<td>187,888</td>
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<tr>
<td>Heart</td>
<td>16,412</td>
<td>17,085</td>
<td>17,700</td>
<td>18,069</td>
<td>18,470</td>
<td>18,988</td>
<td>19,516</td>
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<tr>
<td>Heart-Lung</td>
<td>251</td>
<td>247</td>
<td>236</td>
<td>231</td>
<td>233</td>
<td>243</td>
<td>250</td>
<td>250</td>
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<tr>
<td>Intestine</td>
<td>193</td>
<td>242</td>
<td>291</td>
<td>351</td>
<td>437</td>
<td>531</td>
<td>592</td>
<td>685</td>
<td>765</td>
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<tr>
<td>Kidney</td>
<td>74,606</td>
<td>60,174</td>
<td>65,692</td>
<td>90,743</td>
<td>96,539</td>
<td>102,328</td>
<td>107,979</td>
<td>113,623</td>
<td>116,877</td>
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<tr>
<td>Kidney-Pancreas</td>
<td>4,969</td>
<td>5,272</td>
<td>5,516</td>
<td>5,770</td>
<td>5,984</td>
<td>6,181</td>
<td>6,384</td>
<td>6,612</td>
<td>6,833</td>
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<tr>
<td>Liver</td>
<td>25,964</td>
<td>26,322</td>
<td>30,067</td>
<td>33,162</td>
<td>35,800</td>
<td>38,403</td>
<td>41,213</td>
<td>43,880</td>
<td>46,173</td>
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<tr>
<td>Lung</td>
<td>3,719</td>
<td>4,160</td>
<td>4,491</td>
<td>4,860</td>
<td>5,309</td>
<td>5,888</td>
<td>6,399</td>
<td>6,887</td>
<td>7,326</td>
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<tr>
<td>Pancreas After Kidney</td>
<td>673</td>
<td>645</td>
<td>1,054</td>
<td>1,154</td>
<td>1,385</td>
<td>1,498</td>
<td>1,561</td>
<td>1,621</td>
<td>1,649</td>
</tr>
<tr>
<td>Pancreas Transplant Alone</td>
<td>339</td>
<td>422</td>
<td>527</td>
<td>572</td>
<td>651</td>
<td>719</td>
<td>765</td>
<td>871</td>
<td>963</td>
</tr>
</tbody>
</table>

Source: OPTN/SRTR Data as of October 1, 2010.

For kidney-pancreas recipients, the kidney graft status is used to determine a functioning transplant.
Scope

- 30,970 transplants were performed in 2015

[Graph showing transplants performed in 2015 by organ]
Trends in Transplant Associated Infections

• Infection now exceeds rejection as the precipitating factor in hospitalization in patients in the first two years after a solid organ transplant.

Introduction

There are three types of infection seen after transplant
• “Usual infections”
• “Hibernating infection”
• “Opportunistic infection”
“The Usual”

Common infections anyone can get sick from can have devastating consequences for transplant recipients.

• Pneumonia, UTI (pneumococcal)
• Respiratory viruses
  • Adenovirus
  • Influenza
• Foodborne illness
  • Listeria
“Hibernating” infections

A number of infections which “hibernate” can reactivate after transplant

- Herpes viruses
  - CMV
  - VZV
  - EBV
- Endemic fungi
- TB
True opportunists

Immunosuppression can put patients at risk of “true opportunistic” infections

• Invasive fungal infections
• PJP
• Atypical bacteria
  • Nocardia
  • Atypical mycobacteria
When encountering a transplant patient with signs/symptoms of infection it is common to think....

• It could be anything.....
The differential diagnosis does not have to include “everything”

Risk of Infection

• Net state of immunosupression
  • Transplant type
  • Timing
  • Drugs and treatments
  • Immune modulating Infections

• Epidemiological exposure
  • Transplant type
  • Past exposures
  • Current exposures
Guiding Principals

• Timing is very important
• Not all transplants are created equal
• Patients with transplants have different manifestations of disease than immuno-competent patients
• What happens in Vegas doesn’t stay in Vegas
• An ounce of prevention is worth a pound of cure
Take Home Point

• “You win battles by knowing the enemy’s timing, and using timing the enemy does not expect”

-Miyamoto Musashi
## Changing timeline of infection after organ transplantation

**Donor-derived infection**
- Nosocomial, technical (donor or recipient)
- Activation of latent infection (relapsed, residual, opportunistic)
- Community-acquired

**Recipient-derived infection**
- Dynamic assessment of risk of infection
- Transplant

### Common infections in solid organ transplant recipients

<table>
<thead>
<tr>
<th>&lt; 1 Month</th>
<th>1 - 6 Months</th>
<th>&gt; 6 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infection with antimicrobial-resistant species: MRSA, vancomycin-resistant Enterococcus, Candida (non-albicans)</td>
<td>Infections with PCP and antiviral (CMV, hepatitis B virus) prophylaxis; Polyomavirus BK infection, <em>C difficile</em> colitis, hepatitis C virus infection, adenovirus infection, <em>Cryptococcus neoformans</em> infection, <em>Mycobacterium tuberculosis</em> infection, Anastomotic complications</td>
<td>Community-acquired pneumonia and urinary tract infection; infection with <em>Aspergillus</em>, atypical moulds, and <em>Mucor</em> species</td>
</tr>
<tr>
<td>Donor-derived infection (uncommon) with: HSV, LCMV, rhavadoirus, West Nile virus, HIV, <em>Trypanosoma cruzi</em></td>
<td>Infections without prophylaxis: <em>Pneumocystis</em> infection; infection with herpes viruses; hepatitis B virus infection; infection with <em>Listeria, Nocardia, Toxoplasma, Strongyloides, Leishmania, T cruzi</em></td>
<td>Infection with <em>Nocardia</em> and <em>Rhodococcus</em> species</td>
</tr>
<tr>
<td>Recipient-derived infection (colonization) with: <em>Aspergillus, Pseudomonas</em></td>
<td></td>
<td>Late viral infections: CMV infection (colitis, retinitis), hepatitis (B or C virus), HSV encephalitis, community-acquired infection (ie, SARS, West Nile virus infection), JC polyomavirus infection, skin cancer, lymphoma (ie, PTLD)</td>
</tr>
</tbody>
</table>
Timing is important

First month
• >90% are usual post surgical infections
  • Donor transmitted infection

Months 1-6
• Classic opportunistic infection
• Aspergillus, CMV, HSV, EBV, HBV HCV, HIV, PCP, listeria

More than 6 months
• 80% will have done well, and are at low risk for opportunistic infection
• 10% HBV, HCV, CMV, EBV, Papillomavirus
• 5-10% Chronic rejection
Not all Transplants are created equal

- In general immune suppression from least to greatest
  - Renal < Liver/pancreas < Heart < Lung < Small bowel < BMT
- Rejection and immune modulating viruses increase the level of immune suppression
- Certain classic associations
Net state of Immunosuppression

• **Immunosuppressive Therapy**
  • Dose, duration and sequence

• **Anatomic factors:**
  • Lines, foreign bodies, devitalized tissues

• **Immune modulating events**
  • Rejection
  • Infection; CMV, EBV, Hepatitis B and C, HIV
  • GVHD
Goals of Immunosuppression

Immunosuppression is a balancing act—prevent rejection, but also prevent infection, malignancy and toxicity to maintain patient and graft survival.
Incidence of infection after different organ transplants

<table>
<thead>
<tr>
<th>Type of infection</th>
<th>Liver</th>
<th>Kidney</th>
<th>Heart</th>
<th>Lung/heart-lung</th>
<th>Pancreas/pancreas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial</td>
<td>33–68</td>
<td>47</td>
<td>21–30</td>
<td>35–66</td>
<td>35</td>
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<tr>
<td>Cytomegalovirus</td>
<td>22–29</td>
<td>8–32</td>
<td>9–35</td>
<td>53–75</td>
<td>50</td>
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<tr>
<td>Herpes simplex virus</td>
<td>3–14</td>
<td>53</td>
<td>1–42</td>
<td>10–18</td>
<td>6</td>
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<tr>
<td>Varicella-zoster virus</td>
<td>5–10</td>
<td>4–12</td>
<td>1–12</td>
<td>8–15</td>
<td>9</td>
</tr>
<tr>
<td>Candida species</td>
<td>1–26</td>
<td>2</td>
<td>1–5</td>
<td>10–16</td>
<td>32</td>
</tr>
<tr>
<td>Mycelial fungi</td>
<td>2–4</td>
<td>1–2</td>
<td>3–6</td>
<td>3–19</td>
<td>3</td>
</tr>
<tr>
<td>Pneumocystis carinii</td>
<td>4–11</td>
<td>5–10</td>
<td>1–8</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE.** The data given here represent the range of values found in the literature and in the studies cited by Patel and Paya [1].

CID 2001
<table>
<thead>
<tr>
<th>Transplant Type</th>
<th>Common Infections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renal transplant</td>
<td>- MRSA infections&lt;br&gt;- Hemodialysis access or peritoneal dialysis catheters&lt;br&gt;- Complicated upper-tract urinary infections</td>
</tr>
<tr>
<td>Liver transplant</td>
<td>- Spontaneous bacterial peritonitis&lt;br&gt;- Candida infection&lt;br&gt;- Aspiration pneumonia&lt;br&gt;- Cryptococcal infection</td>
</tr>
<tr>
<td>Lung transplant</td>
<td>- Aspergillus infection&lt;br&gt;- Pneumonias/sinusitis&lt;br&gt;multiresistant organisms (especially in those with cystic fibrosis)</td>
</tr>
<tr>
<td>Heart transplant</td>
<td>- Pneumonias&lt;br&gt;- Intravascular devices&lt;br&gt;- Toxoplasma gondii</td>
</tr>
</tbody>
</table>
What happens in Vegas doesn’t stay in Vegas

Prior exposures are very important
• CMV
• Toxoplasma
• Endemic fungi
• EBV
• HIV
• Hepatitis
“What happens in Vegas doesn’t stay in Vegas”

- Environmental exposures (Current or Past)
  - Blastomycosis, Histoplasmosis: Ohio and Mississippi river valley
  - Coccidiomycosis: dessert southwest USA
  - Mycobacteria; Prisons, nursing homes; foreign born/ travel
  - Strongyloides; Southern states, Jamaica
  - Chaga’s disease; South America
Epidemiological Exposure

Food borne infection;

- *Listeria monocytogenes*; lunch meat, coleslaw, refrigerated food
- Salmonella; poultry, tomatoes, pet turtles
- *Campylobacter jejuni*; raw meat, broiler chickens, surface drinking water
“The patient in the next bed is highly infectious. Thank God for these curtains.”
Epidemiological Exposure

Hospital associated

• Resistant Gram negative bacilli, VRE, MRSA, *c. difficile*
• Aspergillus; construction landscaping
• Legionella water
Case 1

- 66 y/o woman with a history of ischemic cardiomyopathy s/p heart transplant (CMV D+/R-, Toxo D+/R-) one year earlier presented with upper GI distress, nausea and diarrhea.

- She was in her usual state of health until two weeks ago when she began experiencing decreased appetite and nausea. Then, one week ago she began having diarrhea that was preceded by stomach cramping.

- She states that she was having bowel movements every one to two hours and that the stool was watery, non-bloody. Her normal bowel movement frequency is 1/day.

- She did not notice any greasy substance of mucus in the toilet.

- She attributed the her GI symptoms to an increase in her CellCept dose which was increased from 250 mg PO BID to 500 mg PO BID roughly two weeks prior.
ROS

• At the time of admission she denied symptoms including fever, Chills, SOB, CP, orthopnea, PND.
• She did have symptoms of orthostatic hypotension.
Case 1

• She was admitted to the HFT service for hydration and to investigate the cause of her GI symptoms.
• Her CellCept was held but the diarrhea continued.
Past Medical/Surgical History

• Cardiac Txp for ICM s/p 5 doses OKT3, CMV D+/R-, Toxo D+/R-
• Renal insufficiency
• Anemia
• HIT
• Sternal wound closure
• Removal of infected sternal wire
• CABG x2, re-do MVR, MAZE c/b reaction to aprotinin, coma, multisystem organ failure, hemodialysis and foot drop.
• Tricuspid annulus, MVP repair 1996
• Tonsillectomy & Adenoidectomy in childhood
• Tubal Ligation
PRESENT MEDICATIONS:

- Tacrolimus anhydrous 4mg po q12h
- Prednisone 5mg po bid
- Sulfamethoxazole/tmp ds 1tab po 3xweek m w f
- Pantoprazole
- Pravastatin
- Diltiazem cd
- Calcium citrate/vitamin
- Ascorbic acid
- Aspirin
- Vitamin e

ALLERGIES:
1. Heparin-->HIT
2. Aprotinin
SOCIAL HISTORY:

- Remote history of tobacco.
- Drinks 1 alcoholic beverage per week.
- No sick contacts.
- No recent travel.
- No eating out in restaurants.
PHYSICAL EXAM:

VS: T: 100.7 RR: 18 HR: 81 BP: 127/65 91% RA

GEN: Very pleasant, frail appearing woman lying in bed
HEENT: PERRL, Sclera anicteric, conjunctiva clear, No
lymphadenopathy, oral
thrush
CV: RRR NLS1/S2 No M/R/G
PULM: CTAB
ABD: +BS soft, non-tender, nondistended
EXT: No C/C/E no apparent rashes no hands and feet
LABS

- LABS
  - 7.7L
  - 5.9 < 194
    - 22.8L

Basic & Electrolytes:
  - 136 112H 31H  CAL 7.2L
  - < 129H
  - 4.7 17L 2.1H
What to do next?

• Labs
• Other tests
Labs

• Studies
  Stool Cultures NGTD
  C. diff neg X 2
  Rotavirus, Adenovirus Neg
  Giardia antigen Neg
  Shiga-like toxin Neg
WHEN LIFE GIVES YOU LEMONS
BE HAPPY IT WASN'T HERPES.
Other tests

- CMV PCR >1,000,000 copies
Endoscopic appearance
What is CMV?

• Betaherpes virus
  • CMV is latent (once infected, always infected)
  • Cell-associated

• Cytomegalovirus is the most common opportunistic pathogen following solid organ transplantation
CMV

- Infection
- Disease
- Indirect effects
CMV infection

• CMV infection is defined as evidence of CMV replication regardless of symptoms or signs
• Primary CMV infection is acquired through close physical contact with body fluids.
• More than one-half of adults in the United States have serologic evidence of previous infection.
• \( \frac{3}{4} \) of patients have had prior infection with CMV by the time of transplant
• Many blood products are also CMV positive (unless specifically ordered to be CMV negative)
CMV Disease

- CMV disease may manifest as either a viral syndrome (e.g., fever, malaise, leukopenia, thrombocytopenia) or as tissue invasive disease
  - Colitis/gastritis/esophagitis
  - Pneumonitis
  - Meningitis/encephalitis/transverse myelitis
  - Pancreatitus
  - Retinitis
- Patients typically manifest viremia before disease
CMV indirect effects

• Rejection
• Other opportunistic infections
  • PCP
  • Aspergillus
  • Candida
• Bronchiolitis obliterans
• PTLD
Timing

• Most CMV disease occurs between one and four months after transplantation.

• Patients at highest risk for CMV disease are those who are seronegative for CMV (immunologically naive) and receive an allograft from a seropositive donor (D+/R-) and those with latent CMV infection who require treatment with antilymphocyte antibodies as a part of induction therapy or for graft rejection.

• Asymptomatic infection is common in both the D+/R- combination and seropositive recipients.
CMV prophylaxis strategies

• The efficacy of targeted anti-CMV prophylaxis in these high-risk patients is well-documented

• A systematic review of 19 randomized controlled trials of CMV prophylaxis in 1981 solid organ transplant recipients demonstrated the following

• Compared with placebo, prophylaxis with gancyclovir or valgancyclovir significantly reduced the risks of
  • CMV disease (relative risk 0.42, 95 percent CI 0.34-0.52)
  • CMV infection (relative risk 0.61, CI 0.48-0.77)
  • All-cause mortality (relative risk 0.63, CI 0.43-0.92)
CMV prophylaxis strategies

• Preemptive-
  • CMV is monitored with molecular testing, when testing is positive, therapy is initiated (hopefully) before infection can become disease

• Prophylaxis-
  • Taken all the time during highest risk periods to prevent disease
Prophylaxis

• A meta-analysis of 17 universal prophylaxis trials and 9 preemption trials demonstrated that both prophylaxis strategies were equally effective in reducing the incidence of CMV disease.

• However, only universal prophylaxis affected patient survival and reduced graft rejection and reduced the incidence of post-transplant opportunistic infections and post-transplant lymphoproliferative disorder (PTLD).

Preventing post-organ transplantation cytomegalovirus disease with ganciclovir: a meta-analysis comparing prophylactic and preemptive therapies.
Case 2

• Pt is a 67-year-old man with a past medical history of heart transplant for ischemic cardiomyopathy 8 years ago.

• He had one episode of grade IIIA rejection 6 years ago and was treated with a prednisone burst, but has had no significant rejection since then. (CMV D+/R+, Toxo D-/R+)

• He has had no significant unusual infections since transplant either.

• He was doing well until his wife found him on the floor. It was unclear how long he had been down. It appeared he had been incontinent of urine and feces and had at least made some attempts to clean himself when his wife got home. He does not remember other details of his presentation.
ROS

• The patient denies any fevers, chills, sweats, nausea, vomiting, chest pain, headaches, stiff neck, numbness, tingling, weakness, change in his vision, or any other symptoms.

• He does have some chronic diarrhea, but this is unchanged over many years.

• His weight is stable.
PAST MEDICAL HISTORY:

- Coronary artery disease with ischemic cardiomyopathy status post LVAD placement and eventual heart transplant
- Ventral hernia
- Orthostasis
- Hyperlipidemia
- Hypertension
- GERD
- Hiatal hernia
- Hypothyroidism
- Diverticulitis
- Vertigo
Medications on admission

• Ascorbic acid
• Aspirin
• Atenolol
• Calcium citrate
• Fluorouracil topical cream
• Fluticasone nasal inhaler
• Hydralazine
• Levothyroxine
• Lisinopril
• Magnesium oxide
• Mycophenolate
• Pravastatin
• Prednisone 5 milligrams daily
• Tacrolimus 1 milligram q.12,
• Vitamin E

• Medication intolerances include Zantac, Neurontin, Fosamax, and Cipro is listed. The patient tells me his wife told him he was allergic, but he does not know the reaction.
SOCIAL HISTORY:

• He is a retired electrical engineer.
• He is married.
• He lives with his wife.
• They do not have any pets in the home.
• He has no exposure to anyone who has been ill.
• No recent travel or unusual exposures.
FAMILY HISTORY:

• His child died of a malignant brain tumor
PHYSICAL EXAM:

• Afebrile
• General: He appears well and is in no acute distress.
• HEENT: Pupils were equal, round, and reactive to light and accommodation.
• Oropharynx was clear with no evidence of thrush.
• Neck was supple with no lymphadenopathy or JVD.
• Lungs were clear to auscultation bilaterally. Heart had a regular rate and rhythm with no murmurs, clicks, gallops, or rubs.
• Abdomen was soft, nontender, nondistended. There is no hepatosplenomegaly.
• Lower extremity exam, there is no clubbing, cyanosis, or edema.
• Skin exam revealed a bruise on the left side of his chin and an abrasion on his right elbow, likely from his fall. He had no clubbing, cyanosis, or edema.
• On neurologic exam, he is alert and oriented x3; however, there are details of his history he does not seem to remember well. His mental status exam was otherwise intact. He had intact light touch and strength distally bilaterally.
LABORATORY EVALUATION:

• White blood cell count is 8.1.
• Hemoglobin is slightly low at 12.4
• platelets are normal at 259.
• BNP was mildly elevated at 134,
• AST was mildly elevated at 35, but the remainder of the LFTs are normal.
• Creatinine is elevated at 1.7.
• Urinalysis was negative.
• T4 was normal at 0.97.
LP

- CSF revealed 1 white blood cell.
- Cryptococcal antigen from the CSF was negative.
- CSF protein is very mildly elevated at 55.
- Glucose is normal at 59.
- There 24% neutrophils, 29% lymphocytes, and 20% histiocytes.
- Culture of the CSF is negative.
Additional testing

• CMV PCR from the plasma was negative.
• Toxo PCR from the blood and the CSF are negative.
• Serum cryptococcal antigen is negative.
• Flow off the CSF is unremarkable.
• CSF fungal smear and culture is negative.
• Feces cultures has no enteric pathogens to date.
• Shigalike toxin is negative.
• AFB culture from the CSF is negative.
• Aspergillus galactomannan assay negative.
• QuantiFERON gold is negative.
• EB quantitative PCR from the serum and CSF is negative.
• Fungal serology panel is negative.
• JC virus DNA PCR from the CSF is negative.
• HHV-6 PCR from the CSF is negative.
• CMV PCR from the CSF is negative.
• CSF fungal serology panel negative.
What next?

• Where tumor is the rumor; tissue is the issue
Path result
Toxoplasmosis

- Toxoplasmosis, an infection with a worldwide distribution, is caused by the intracellular protozoan parasite, *Toxoplasma gondii*
Life cycle

• Cats are the only animals in which T. gondii can complete its reproductive cycle.

• A cat ingests the parasite and it infects the gut epithelial cells of the animal and reproduces.

• The cat then excretes infectious oocysts in feces.

• When non-felines, including humans, ingest T. gondii oocysts, the organisms invade intestinal epithelium and disseminate throughout the body.

• They then encyst in any type of nucleated cell and can lie dormant within tissues for the life of the host.
Both oocysts and tissue cysts transform into tachyzoites shortly after ingestion. Tachyzoites localize in neural and muscle tissue and develop into tissue cyst bradyzoites. If a pregnant woman becomes infected, tachyzoites can infect the fetus via the bloodstream.

**Diagnostic Stage**
1) Serological diagnosis.
   or
2) Direct identification of the parasite from peripheral blood, amniotic fluid, or in tissue sections.

CDC
SAFER • HEALTHIER • PEOPLE
http://www.dpd.cdc.gov/dpdx
How do you get it?

• Ingestion of infectious oocysts from the environment (usually from soil contaminated with feline feces)
• Ingestion of tissue cysts in meat from an infected animal
• Through vertical transmission from an infected mother to her fetus
• Via blood transfusion or organ transplantation from an infected donor
Cats get a bum rap...
Cats and Toxo

• Cats excrete the pathogen in their feces for a number of weeks after contracting the disease, generally by eating an infected rodent.

• Even then, cat feces are not generally contagious for the first day or two after excretion, after which the cyst 'ripens' and becomes potentially pathogenic.

• Studies have shown that only about 2% of cats are shedding oocysts at any one time, and that oocyst shedding does not recur even after repeated exposure to the parasite.

• Although the pathogen has been detected on the fur of cats, it has not been found in an infectious form, and direct infection from handling cats is generally believed to be very rare.
Who gets it?

• In the United States 11 percent of persons aged 6 to 49 are seropositive for *T. gondii*.

• The incidence is higher in African American persons and in persons born outside the United States.

• For persons aged 12 to 49 born in the United States, the seroprevalence declined between 1999 and 2004 (14 to 9 percent)

• In France, and in some developing countries, the prevalence is as high as 87 percent.
Why is this so important in heart transplant recipients?

• Given that cysts of Toxoplasma gondii are commonly found in muscle tissues, the greatest risk for toxoplasmosis occurs after cardiac transplantation.

• Can also be due to reactivation under immunosuppression in cases of pretransplant infection

• The highest risk group for symptomatic reactivation disease occurs in seronegative recipients of heart transplants from seropositive donors

• The risk in this group in the absence of prophylaxis is approximately 50 to 75 percent

Toxoplasmosis in heart transplant recipients.
Symptomatic Reactivation

• Organ-transmitted disease is generally more severe than that due to reactivation of latent infection in the recipient. The risk of disease reactivation appears to be increased by use of lymphocyte-depleting induction therapy

What does Toxoplasma cause?

- Encephalitis
- Abscess in heart, liver
- Inner ear damage
- Chorioretintis
Is there any way to prevent it?

• Typically seronegative recipients of seropositive cardiac transplants receive at least 6 weeks to 6 months of prophylaxis, although lifetime prophylaxis is preferred at many centers.

• One retrospective study suggests that (TMP-SMX) at a dose of one double-strength tablet three times per week is sufficient for both Pneumocystis and Toxoplasma prevention in cardiac transplant recipients.

• Other centers use lower dose regimens or add pyrimethamine to TMP-SMX in high-risk recipients.

• A Clindamycin-pyrimethamine regimen has been used successfully in some programs as an alternative for those who are intolerant of TMP-SMX.
Case 1

- 36-year-old woman with a history of DM since age 3 had combined kidney-pancreas transplant one year previously.
- 4 days prior to admission the patient developed generalized malaise.
- The following day, she discovered a raised red spot on her neck.
Case 1
Case 1

• The day of admission she noted increasing malaise/myalgia, fever, SOB, nausea and vomiting, and multiple maculopapular spots on her trunk and limbs.
Case 1
Case 1
Case 1

- Apparently, the patient had never had chickenpox or vaccination for varicella before.
- Her mother had an outbreak of Herpes Zoster on her face/scalp 3-4 weeks before and the patient spends much of her time with her, including caring for the wounds.
Case 1

• She developed disseminated Varicella Zoster infection, with pneumonitis and hepatitis and was hospitalized for more than 3 weeks but did eventually recover.
Your friendly Transplant ID doctors are not happy when patients get vaccine preventable diseases.....
“Don’t think of it as getting a flu shot. Think of it as installing virus protection software.”
Rationale for vaccinations in transplant candidates and recipients and those who care for them...

- There is very little risk from appropriate, approved vaccination
- The timing of vaccination is important
  - Pre-transplant seems better than post; but some is usually better than none
- Patients with SOT are at increased risk from the *complications of infection* from “vaccine preventable” illnesses.
- Patients who are exposed to a pathogen may require an aggressive approach with vaccination (active or passive) and anti-infective prophylaxis with exposure.
- Vaccination of household contacts and health care workers is important.
Pre-immune suppression immunization Evaluation

• IS THE PATIENT IMMUNE SUPRESHED ALREADY?
  • The history or titer for varicella
  • A complete vaccination history
  • Titers
    • Hepatitis B surface antibodies
    • Immunoglobulin G against hepatitis A
    • Measles, mumps, and rubella

• When available, antibody titers should be rechecked after vaccination to assess the need for booster doses, especially if ESRD or ESLD is already present
## Table 5.
Vaccinations Prior to or After Solid Organ Transplant

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Pretransplant</th>
<th>Starting 2–6 mo Posttransplant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemophilus influenzae b conjugate</td>
<td>U: age 12–23 mo</td>
<td>U, if not completed pretransplant</td>
</tr>
<tr>
<td>R: ≥2 y</td>
<td>Strong, moderate</td>
<td>Strong, moderate</td>
</tr>
<tr>
<td><strong>Hepatitis A</strong></td>
<td>U: age 1–18 y</td>
<td>R, if not completed pretransplant</td>
</tr>
<tr>
<td>R: ≥18 y</td>
<td>Strong, moderate</td>
<td>Strong, moderate</td>
</tr>
<tr>
<td><strong>Hepatitis B</strong></td>
<td>U: females 11–26 y</td>
<td>U: females 11–26 y</td>
</tr>
<tr>
<td>R: age 11–26 y</td>
<td>Strong, low</td>
<td>Strong, moderate</td>
</tr>
<tr>
<td><strong>Influenza-inactivated (inactivated influenza vaccine)</strong></td>
<td>U</td>
<td>U^b</td>
</tr>
<tr>
<td><strong>Influenza-live attenuated (live attenuated influenza vaccine)</strong></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Measles, mumps, and rubella-live</strong></td>
<td>R^c: 6–11 mo</td>
<td>X</td>
</tr>
<tr>
<td><strong>Measles, mumps, and rubella-varicella-live</strong></td>
<td>U^c: age ≥12 mo</td>
<td>X</td>
</tr>
<tr>
<td><strong>Meningococcal conjugate</strong></td>
<td>U</td>
<td>X</td>
</tr>
<tr>
<td><strong>Pneumococcal conjugate (PCV13)</strong></td>
<td>U: age ≤5 y</td>
<td>U: Age 2–5 y if not administered pretransplant</td>
</tr>
<tr>
<td>R: age ≥6 y</td>
<td>Strong, moderate</td>
<td>Strong, very low</td>
</tr>
<tr>
<td><strong>Pneumococcal polysaccharide (PPSV23)</strong></td>
<td>R: age ≥2 y</td>
<td>R: age ≥2 y if not administered pretransplant</td>
</tr>
<tr>
<td><strong>Polio-inactivated (inactivated poliovirus vaccine)</strong></td>
<td>U</td>
<td>U</td>
</tr>
<tr>
<td><strong>Rotavirus-live</strong></td>
<td>U^ε: 6–11 mo</td>
<td>X</td>
</tr>
<tr>
<td><strong>Varicella-live</strong></td>
<td>U^ε: age 50–59 y</td>
<td>X</td>
</tr>
<tr>
<td>R: age 50–59 y</td>
<td>Weak, low</td>
<td>Strong, low</td>
</tr>
<tr>
<td><strong>Zoster-live</strong></td>
<td>R: age ≥60 y</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Strong, moderate</td>
<td>Strong, low</td>
</tr>
</tbody>
</table>
What else can I do to decrease my risks?
Risk reduction

• Food safety
• Pets and Animals
• Activities
• Travel
Food Safety

- Counseling on food and water safety and risk reduction
Pets: associated infection

• Cats (toxo, dermatophytes, bartonella)
• Dogs (*Bordetella bronchiseptica, parainfluenza, and mycoplasma*)
• Birds (psitticosis, giardia, cryptococcus)
• Reptiles (Salmonella)
• Exotic pets: Prairie dogs, rats (Monkey pox, LCV)
• Farm Animals (brucella, dermatophytes *Mycobacterium bovis*, bartonella, West Nile virus)
GIMME YOUR WALLET!
I HAVE A PRAIRIE DOG AND I'M NOT AFRAID TO USE HIM!!
Travel Activity Guides

American Journal of Transplantation

• Prevention of Infection in Adult Travelers After Solid Organ Transplantation; 01/31/2005

• Patients should meet with ID/travel medicine before international travel to developing/tropical countries
Practice good hand hygiene!
Questions?
OF COURSE I'M AN ORGAN DONOR. WHO WOULDN'T WANT A PIECE OF THIS?

I'm a mom and a doctor

What's your superpower?