The Good, The Bad, and The Ugly

Bacterial Colonization Versus Infection

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Objectives

- Sterile versus non-sterile sites
- Signs and symptoms of infection
- Normal flora in the human body
- Common colonizers based on suspected site of infection

Colonization versus Infection

- To Treat or Not to Treat?
  - Is the positive culture from a sterile or non-sterile site
  - Does the patient have other signs and symptoms of infection?
  - What risk factors are present that predispose the patient to developing an infection?

To Treat or Not to Treat?

- *Is the positive culture from a sterile or non-sterile site?*
  - Non-sterile site may or may not be indicative of an infection
  - Sterile site is highly suggestive of infection
- Always evaluate positive cultures in conjunction with clinical signs and other diagnostic results

Sterile V. Non-Sterile Sites

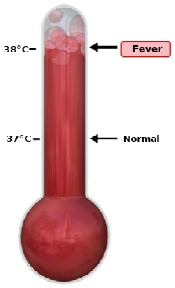
- Sterile
  - Fluids
    - Blood, CSF, pleural fluid, peritoneal fluid, pericardial fluid, joint fluid
  - Internal Body Sites
    - Organs
    - Specimens obtained intraoperatively
- Non-Sterile
  - GI tract
  - GU tract
  - Skin
  - Mouth
  - Upper Respiratory Tract
    - ***Sputum***

To Treat or Not to Treat?

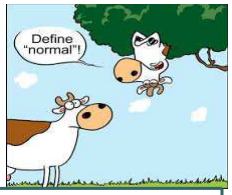
- *Does the patient have signs of infection?*
  - Fever
    - Age
  - Leukocytosis
    - Stress, Trauma, Steroids, Inflammation
  - Hemodynamic instability
    - Dehydration
    - Underlying cardiac conditions
    - Secondary to medications
    - Underlying respiratory disease
    - Low baseline respiratory rate.

Signs of Infection

- Fever
  - oral temp > 100.4F (38C)
- Leukocytosis or Leukopenia
  - +/- increase in immature neutrophils (*bands*)
- Tachypnea/Tachycardia
  - RR >20 or PaCO2 <32 mmHg
  - HR >100
- Hypotension
  - SBP < 90 mmHg
- ***Positive Culture***



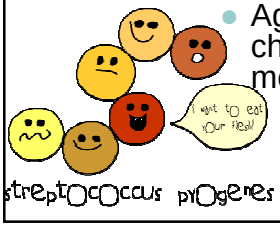
Normal Flora



Body Site	Indigenous Microbiota
Skin	Diphtheroids (e.g. *Corynebacterium spp.*), *Propionobacteria*, Staphylococci (especially *Staph. epi*)
Gastrointestinal tract	*Bacteroides spp.*, *Clostridium spp.* (some species), Diphtheroids, Enterobacteriaceae (e.g., *E.coli, Klebsiella spp.*), Enterococcus, *Candida spp.* (usually *C. albicans*)
Upper respiratory tract	*Haemophilus spp., Neiserria spp., Viridans strep., Strep. pneumo.*, Staphylococci, Diphtheroids
Genital tract	*Corynebacterium spp.*, Enterobacteriaceae, *Lactobacillus, spp.*, *Mycoplasma spp.*, Staphylococci, Streptococi, *Candida spp.*

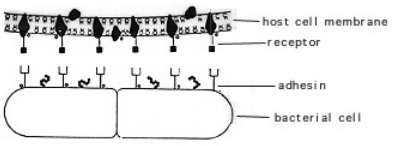
To Treat or Not to Treat?

- *What risk factors are present that predispose the patient to developing an infection?*
- Amount of bacteria per gram of tissue
  - >100,000 org/g of tissue generally necessary for infection to occur
- Ability of the host to mount an effective immune response
  - Age, poor nutrition, obesity, diabetes, chronic steroid use, compromised immunity, medications



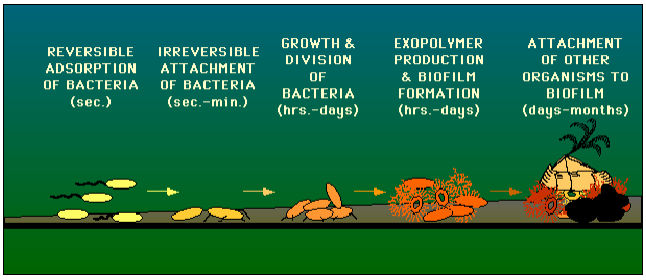
Colonization versus Infection

- Colonization mechanism
  - Tissue tropism
    - Preference for certain tissue for growth
  - Specific adherence
    - Biochemical interactions between surface components



Colonization versus Infection

- Colonization mechanism
  - Biofilm Formation
    - Classic example is plaque formation on teeth



Colonization versus Infection

Bacteria	Site of colonization	Pathogenic Impact
MRSA	Nostrils, belly button, under arms, groin, etc	Bacteremia, Pneumonia, Endocarditis, Meningitis, Osteomyelitis
E. Faecalis (VRE)	Gastrointestinal tract	Bacteremia, Endocarditis, Pyelonephritis
Strep. pneumo	Upper respiratory tract	Pneumonia (LRT), Meningitis
S. pyogenes	Mouth/Pharynx	Pneumonia, Endocarditis, Nephritis, Rheumatic Fever, CSSI
Neisseria	Upper respiratory tract/Pharynx	Meningitis
E. Coli	Small intestine	Bacteremia, Intestinal infections, UTI
Pseudomonas aeruginosa	Small intestine	Quintessential opportunistic pathogen of humans

Impact of Colonization

- MRSA colonization and infection in a long-term care facility
- 197 patient on two units followed with regular surveillance cultures
  - Infection rate based on colonization type
    - 4% MSSA colonized
    - 4.5 % non-colonized
    - 25% MRSA colonized
  - 73% of all MRSA infections occurred in MRSA colonized patients

Impact of Colonization

- Review of 74 studies published on nosocomial colonization or infection risk factors
- Seven types of risk factors most likely to result in colonization or infection with multiresistant species
  - Advanced age
  - Severity of illness
  - Inter-institutional transfer
  - Prolonged hospital stay
  - Gastrointestinal surgery
  - Transplantation
  - Exposure to medical devices, especially CVCs
  - Heavy exposure to broad spectrum antimicrobials, especially cephalosporins (universal result)

Impact of Colonization

- Antibiotic exposure
  - Cumulative effect
  - Alteration through changes in the structure and function of gut microbiota
    - Decreased colonization resistance
  - Changes not necessarily reversible
  - Recurrent CDI may be due to patients with gut microbial alteration sufficient to eliminate restoration of colonization resistance after treatment.
    - Reason stool transplant may be so successful (92% in recent meta-analysis)

Conclusions

- Colonization is successful occupation of a new habitat by a species not normally found in this niche
- Positive cultures should be evaluated in the setting of clinical signs and symptoms
- Antibiotic use alters the human indigenous microbiota which can allow for colonization
- Colonization can result in the host having increased susceptibility to developing an infection

References

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Questions?