

Infection Detection in Chronic Wounds

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Objectives

- Describe factors contributing to the emergence of chronic wound infections
- Identify the patient at risk for a clinical wound infection.
- Discuss the impact of tight glucose control and infection rates
- Identify measures to prevent infections
- Identify measures to treat infections

Bacterial Infection depends on:

- Number of organisms present- bioburden
- Their virulence
- Host resistance

Definitions

- Acute wounds- are fresh injuries that heal in an orderly and timely fashion and achieve sustained anatomic and functional integrity
- Chronic wounds- do not heal in an orderly or timely fashion nor achieve sustained anatomic or functional integrity

Definitions:

- Wound Contamination- presence of non-replicating organisms within a wound.
- Wound Colonization- presence of replicating microorganisms adherent to the wound in the absence of injury to the host.
 - Staphylococcus epidermis and Corynebacterium (has shown to accelerate wound healing)

Definitions.....cont.

- Wound Infection- presence of replicating microorganisms within a wound with subsequent host injury.
Infection= $\frac{\text{dose} \times \text{virulence}}{\text{host resistance}}$

Continuous presence of virulent population causes:

- Persistent production of inflammatory mediators such as prostaglandin E2, thromboxane, cytolytic enzymes and free oxygen radicals.
- Localized Thrombosis and release of vasoconstricting metabolites which leads to hypoxia and tissue destruction.
- Depletion of platelets and complement.

Infection causes.....cont.

- Down regulation of immune response.
- Fibroblasts reduced in number.
- Wound hypoxemia due to larger vessel occlusion.
- Impaired granulation.
- Reduced tensile strength.
- Impairment of epithelialization.

Health Care Providers focus

far too often on the microorganism rather than the host.

Interpreting a Microbiology Report examine these 4 areas

- Anatomic location – correct location with correct terminology – if foreign body – hardware, splinter
- Gm Stain for all wounds – look for presence of WBC's
- Antibigram – id's antibiotics organism is susceptible or resistant
- Organisms – need to know epidemiology of the organism isolated – source is the clue to the mode of transmission

Typical Features of Localized Wound Infection Include:

- Increased exudate
- Swelling
- Erythema
- Pain
- Increase local temperature

Wound exudate need not be purulent.....

It may present as the “dishwater pus” due to bacterial phospholipases, enzymes, and toxins destroy neutrophils

Other important clues:

- Periwound cellulitis
- Ascending infection
- Abnormal wound discharge
- Odor
- Change in appearance of granulation tissue
- Alteration in pain
- Sudden high glucose level

– Stotts, 1999 & Pliskin & Todd, 1994

Be suspicious when a patient presents with:

- Ischemia
- Steroids
- Malnutrition
- Diabetes
- Elderly

group A beta hemolytic streptococci

are always significant when isolated in a wound and must be treated systemically immediately regardless of the quantity

Five Key Steps From IHI Institute for Healthcare Improvement

- Perform hand hygiene – hand sanitizers are a suitable substitute
- Rooms must be cleaned well and often – terminal clean
- Actively look for MRSA – surveillance cultures in 80% of the population
- Implement contact precautions – right away
- Bundle best practices – VAP's, UTI's, Central Line, Skin Bundle

Why are patients with wounds at higher risk for resistant organisms?

- Frequent hospitalizations
- Long lengths of stay – PU 13 days extended
- Frequent re-admissions
- Prolonged exposure to multiple antibiotics
- Compromised

Mean number of isolates per wound

- In Infected Chronic Wounds
 - anaerobes- 3.5
 - aerobes- 2.3

– Bowler & Davies, 1999

Anaerobic organisms are more likely to be isolated in wounds

complicated by Osteomyelitis.
MRSA – common pathogen associated with OSTEO

Aerobic gram-negative rods are:

- Tend to be water-loving
- Introduced into the wound from exogenous sources such as bath water and foot wear.
- Include Pseudomonas, Acinetobacter, and Streptophomonas
- Clinically associated with marked wound deterioration due to presence of endotoxin, tissue-destructive enzymes, and exotoxins
- Wounds below the waist contaminated by shower from fecal runoff

Typical signs of gram-negative rod infections:

- Watery pus
- Staining of wound margins and dressing with green pigment (pyocyanin)
- Repugnant sweet smell

Diagnosis of Osteomyelitis:

- Often delayed
- Often associated with LEAD
- Occurs at sites of increased bone perfusion
 - Charcot
- Directly proportional to the depth of soft tissue intervening between skin and bone
- Ulcer duration, depth and anatomic location are predictors.

Osteomyelitis.....cont.

- Most specific test is sterile palpation or use of a sterile probe.....If bone is encountered, osteomyelitis is present.
- Plain radiography.....most common. If negative, redo in 14 days. Difficult to differentiate between osteo and charcot.
- Magnetic Resonance Imaging.....poor specificity. Only considered if X-ray negative yet wound fails to progress

Host Resistance

single most important determinant of wound infection and must be meticulously assessed in every situation where a chronic wound fails to heal.

Local factors:

- Wound
 - duration
 - size
 - depth (probe to the bone)
 - location
 - amount of perfusion
 - cellulitis extending 1 cm or more

Systemic factors:

- Vascular disease
- Edema
- Malnutrition
- Diabetes Mellitus
- Alcoholism
- Prior surgery or radiation
- Corticosteroids

Prevention of Infection Measures

- Keep wound moist
- Irrigating wounds
- Use absorbent dressings
- Increasing the frequency of dressing changes
- Oxygenation
- Perfusion
- Nutritional Support

Treatment

- Enhance the generalized host defense mechanisms (treat the underlying cause of delayed wound healing).
 - reconstructive vascular surgery
 - optimal blood sugar
 - smoking cessation
 - heart failure management
 - edema control

Treatment.....cont.

- nutritional therapy
- hydration
- reduction in repetitive wound trauma or pressure
- reduction in immunosuppressive agent (where possible)

Treatment.....cont.

- Debridement- remove debris
 - Converts the down-regulated indolent wound into an active wound through release of growth factors and tissue cytokines
 - Surgical debridement highly recommended
- Wound Cleansing- physiologically removes debris
 - Saline at pressures of 8-15 psi
 - TechniCare Surgical Scrub

Treatmentcont.

- Appropriate use of some antiseptic solutions may be acceptable for a limited period of time may be acceptable.
 - sodium hypochlorite .005%
 - acetic acid .0025%

Antimicrobial Wound Care Products & Technology for Localized Tissue Infections

- Cadexomer iodine (Iodosorb- controlled release of iodine)
- Silver dressings – Tegaderm AG Mesh
- NPWT

Systemic antimicrobial therapy

Should be initiated for all chronic wounds that, after a thorough assessment, are felt to have active infection invading beyond the level that can be managed with local wound therapy.

Antibiotic therapy.....cont.

- Culture the wound before antibiotics are started
- Narrow the spectrum of antibiotics based on the cultures
- Review all culture reports to verify bacteria are sensitive to the antibiotics – monitor wound
- Administer antibiotics appropriately – right time
- Teach patient how to use antibiotics and finish entire course

Osteomyelitis

3 months of antibiotic treatment is average length of treatment to eradicate infection.

Consider these questions when developing a strategic plan to address infection.

How do you recognize and diagnose wound infection in your setting?

What are your criteria for culturing?

What culturing method do you choose and why?

Does the patient have diabetes?

- Diabetes
 - Is the most expensive chronic disease in the USA
 - TGC can reduce incidence of postoperative wound infections
 - Common pathogens are S Aureus, Klebsiella, group B Strept, and Salmonella enteritidis
 - Monitor and manage multiple factors – environment, bacterial proliferation, sluggish immune response, advanced atherosclerosis, impaired wound healing
 - Goals – early ID hyperglycemia, implement protocols and educate staff on effects of TGC and wound healing

Early detection of infection prompt treatments and continuous surveillance are pivotal to elimination of the infection, prevention of complications, and facilitating positive patient outcomes.

In Conclusion

- Communicate with your colleague's in the microbiology laboratory.
- Assess thoroughly, be suspicious.
- Get involved in the effort to stop the spread of infections
- Institute best practices – for patient care and prevention of harm

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