Signs, Symptoms and Actions for
Superficial and Spreading Wound Infection
(All Etiology’s)

**Classic Signs of Inflammation**

- **Calor, rubor, tumor, dolor**
- Heat, redness, swelling and pain are the four classical signs of inflammation, originally recorded by the Roman Celsius in the 1st century A.D.
- However, we now know that infection may produce different signs and symptoms in wounds of different types and etiologies; and
- Superficial/localized infections are different than /produce different signs than deep/spreading infections; and
- Require different treatments

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<tr>
<th>Term</th>
<th>Clinical Interpretation</th>
<th>Clinical intervention</th>
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| Need for Prophylaxis  | Wounds in at-risk individuals can quickly progress to colonized or infected (could include wounds with or where you want to create dry stable gangrene) | 1. Optimize general health of individual (nutrition, medication, manage co-morbidities etc.)
2. Thorough cleansing, debridement if applicable, and infection control practices to prevent introduction of bacteria.
3. Utilize topical antimicrobial dressings |
| Contaminated          | Bacteria on surface only
No signs or symptoms                                                | None                                                                                   |
| Colonized             | Bacteria attached to surface
Starting to form colonies
Minimally invasive
No local tissue damage                                      | None unless location of wound or host resistance put patient at risk                     |
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| **Localized Infection (Critical Colonization)** | Bacteria more deeply invasive  
Local wound bed involved  
Healing delayed or stalled  
Subtle signs and symptoms  
- Friable bright red tissue  
- Increased or altered exudate  
- Increased odour  
- Increased pain  
- Localized edema | Intervention required.  
Local measures  
- Effective debridement  
- Topical antimicrobials to cleanse  
- Antimicrobial dressings*  
* Each etiology-based resource contains specific topical dressing choices for infected wounds.                                                                                                                                                                                                                   |
| **Spreading Infection**                         | Bacteria now involve surrounding tissue. In addition to signs and symptoms of localized infection:  
- Erythema and induration beyond wound edge  
- Heat  
- Increased pain  
- Satellite lesions  
- Lymphangitis  
- General malaise | As for localized infection plus systemic antibiotics, which need to correspond to the sensitivities of the actual bacteria causing the infection. Sometimes coverage for BOTH aerobic and anaerobic bacteria needs to be ordered (especially with diabetic foot ulcers and pilonidal sinuses), and more than 1 course of systemic therapy may be needed.  
- General Anti-infective Guidelines for Community-acquired Infections (www.mumshealth.com)  
| **Systemic infection**                          | Classic signs of sepsis  
- Fever  
- Elevated or depressed WBC  
- Tachycardia  
- Tachypnea  
- Multi-organ system failure | As for spreading infection  
Need to rule out other sources of infection                                                                                                                                                                                                                                                                                                                                                           |

Table adapted from SWRWC Toolkit: E.3. Wound Infection Treatment_ forTopicals_AntimicrobialRx_Biofilm_Jun_27_2011
Identification and Classification of Signs of Infection (NERDS & STONEES)

**Mnemonics for Wound Infection**  
(Sibbald, Woo, Ayello ‘06, Woo & Sibbald ’09)

- **NERDS**  
  Superficial: Treat topically
  - Non-healing
  - Exudate
  - Red + Bleeding
  - Debris
  - Smell

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**NERDS**

- **Non-healing**  
  Wounds that are not 20% to 40% smaller in 4 weeks according to patient history or existing documentation  
  Sibbald, Woo, Ayello ‘06, Woo & Sibbald ’09

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- **Exudate**  
  - Increase in wound exudate can be indicative of bacterial pro-inflammatory damage and leads to periwound maceration  
  - More than 50% of the dressing stained with exudate  
  Sibbald, Woo, Ayello ‘06, Woo & Sibbald ’09

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- **Red**  
  - Wound bed tissue is bright red with exuberant granulation tissue  
  - Tissue bleeds easily with gentle manipulation  
  Sibbald, Woo, Ayello ‘06, Woo & Sibbald ’09

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- **Debris**  
  - Presence of discolored granulation tissue, slough, and necrotic/nonviable tissue  
  Sibbald, Woo, Ayello ‘06, Woo & Sibbald ’09

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- **Smell**  
  - Unpleasant or sweet, sickening odor  
  Sibbald, Woo, Ayello ‘06, Woo & Sibbald ’09

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**Validation of NERDS**

Any 3 or more of the following indicate HIGH superficial bacterial infection:
- Non-healing
- Exudate increased
- Red friable
- Debris
- Smell
  

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**www.calgarylabservices.com**
Signs, Symptoms and Actions for Superficial and Spreading Wound Infection Oct 20, 2014

Identification and Classification of Signs of Infection (NERDS & STONEES)\(^\text{ii}\)

### Mnemonics for Deep or Spreading Wound Infection

**STONEES**

- **S**ize Increased
  - Size as measured by the longest length and the widest width at right angles to the longest length.
  - Depth measured with a probe straight in

- **T**emperature
  - Increased periwound margin temperature by more than 3\(^\circ\)F difference between two mirror-image sites

- **O**s
  - Wounds that have exposed bone or that probed to bone at the time of examination have risk of osteomyelitis

- **N**ew
  - New areas of breakdown or satellite lesions

- **E**rythema & **E**xudate
  - Reddened skin in periwound area
  - Presence of swelling in periwound area
  - Increased amount of drainage

### STONEES

- **S**ize is bigger
- **T**emperature ↑
- **O**s (probes, exposed)
- **N**ew breakdown
- **E**rythema, **E**dema (Signs of Cellulitis)
- **Exudate**, **S**mell

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(Dr. R.G. Sibbald, Woo, Ayello ‘06, Woo & Sibbald ‘09)

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(Adapted from CAWC Conference 2011 Dr. R.G. Sibbald)

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(CarePartners 2006)

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**Identification and Classification of Signs of Infection (NERDS & STONEES)**

### STONEES

**Smell**
- Unpleasant or sweet, sickening odor  
  
  Sibbald, Woo, Ayello ’06, Woo & Sibbald ’09

### Validation

**STONEES**

Any 3 or more of the following indicate **HIGH** bacterial infection in the deep compartment:
- Size increasing
- Temperature increasing
- Os; probes to bone
- New or satellites
- Erythema
- Edema
- Smell


**StoneES**

Any 3 or more of the following indicate HIGH bacterial infection in the deep compartment:
- Size increasing
- Temperature increasing
- Os; probes to bone
- New or satellites
- Erythema
- Edema
- Smell


### Other Signs /Symptoms of Deep or Spreading Infection

**Pilonidal Sinus Wounds:**
Premature Bridging of Epithelial or Granulation Tissue & Pocketing in the Base

![Pilonidal Sinus Wounds](image)

All 3 photos ©CarePartners

### Single Symptom of Infection

- New, increased or altered **PAIN** is individually highly indicative of infection.

**Wong-Baker FACES Pain Rating Scale**

©CarePartners

### Other Predictors of Osteomyelitis in Diabetic Foot Ulcers

- An ulcer area greater than 2cm²
- Erythema, Soft tissue edema or joint effusion
- Lethargy, malaise, fever
- ESR (erythrocyte sedimentation rate) of more than 70 mm/h
- Xray flat plate / MRI if available
- If MRI is unavailable or contraindicated, a labeled white blood cell scan is the best alternative

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Remember that signs and symptoms of deep or spreading infection include Size, Temperature, Os (Probes to bone), New areas of satellite breakdown (beyond the original wound) and/or recurrence of wounds within a short period of time, Erythema and Smell (STONEES).

Cellulitis is a spreading bacterial infection of the dermis and subcutaneous tissues, where the edge of the erythema may be well-defined or more diffuse and typically spreads rapidly. Systemic upset with fever and
Malaise occurs in most cases, and may be present before the localising signs such as the local symptoms seen with STONEES.

Lower leg cellulitis can be extremely serious with long-term morbidity, including lower leg edema. It requires prompt recognition by health care providers and appropriate interventions.

Note that lower leg cellulitis usually affects only one leg, not both. If both legs are affected, it is likely venous dermatitis or allergic contact dermatitis, but this does not mean that it could never be cellulitis in both legs.

### Risk Factors for Lower Leg Cellulitis

- Takes only a pin-point opening in the skin for bacteria to enter
- Maceration between toes in web space
- Tinea pedis (Athlete's foot)
- Lower leg oedema of any etiology especially lymphedema
- Obesity
- Recent surgery (especially vein harvesting for bypass grafting)
- Venous stasis dermatitis
- Any blunt trauma to the leg
- Leg ulceration
- White ethnicity

Halpern et al 2008 Br J Dermatol

### Lower Leg Cellulitis

- Symptoms: may have fever, area painful and may not tolerate current compression esp. elastic types
- Signs:
  - Cellulitis appears as a diffuse, bright red, hot leg with tenderness and often fever.
  - Clear serous exudate will “pour” out of the small openings, saturating the dressings quickly.
  - May have bullae or blisters unrelated to venous disease
- Investigations: high WBC, increased ESR and C-reactive protein.
- Blood culture usually negative; swabs C&S usually negative unless necrotic tissue is swabbed (which is inappropriate)

howshealth.com

### Superficial Surgical Site Infection (SSI)

Specific signs of superficial Surgical Site Infection (SSI) -

- Involves only skin and subcutaneous tissue around the incision, occurring within 30 days of the procedure, and have at least one of the following criteria.
  - Greenish/brown/pus or foul smelling drainage
  - Increased pain or tenderness in the area of the incision or wound
  - Increased swelling, firmness, redness or heat surrounding the incision/wound
  - Fever higher than 38°C (100°F) -- older individuals may have fever at a lower temperature 37°C (99°F)
  - A closed incision that opens up and starts to drain
  - A tired feeling that doesn’t go away
  - Localized swelling + increased exudate
  - Organisms isolated from an aseptically obtained culture of fluid or tissue from the incision
  - The incision is deliberately opened by a surgeon, unless the culture is negative
  - The following are NOT considered superficial SSIs:
    - Stitch abscesses
    - Infection of an episiotomy or neonatal circumcision site

Deep tissue infection: involves the deep tissue including muscle and fascia

Organ or space infection: involves body or cavity where surgery took place

As for superficial infection PLUS:

- Further extension of erythema
- Lymphangitis - Thin red lines observed running along the course of the lymphatic vessels in the affected area, accompanied by painful enlargement of the nearby lymph nodes known as “blood poisoning in layman’s terms”
- Crepitus in soft tissues
- Wound breakdown/dehiscence

Specific Signs of deep incision Surgical Site Infection (SSI), affecting the fascia and muscle layers, or organ or space related to the procedure, which involves any part of the anatomy other than the incision that is opened or manipulated, within 30 days or within one year if implant in place, and have at least one of the following criteria:

- Pusurulent drainage from the incision but not from the organ/space of the surgical site
- A deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms
### Other Signs /Symptoms of Deep or Spreading Infection

- fever (>38°C), localised pain or tenderness - unless the culture is negative
- an abscess or other evidence of infection involving the incision is found
- diagnosis of a deep incisional SSI by a surgeon or attending physician

### Levine Method Swab for Culture and Sensitivity

**Determining Type & Amount of Bacteria**

- Culture and sensitivity (c&s) results are not necessary to confirm the presence or absence of infection
- Important to determine what bacteria is present and which antibiotic they are sensitive to.

**Validated method**

- There is a linear relationship between quantitative tissue biopsy and swab for culture using a specific method (Levine)

**Limitations of Swabs**

- The c&s results may not reflect the presence or absence of biofilm, or test for all bacteria present

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Levine Method Swab for Culture and Sensitivity

Procedure
- The laboratory will require a lab requisition from the physician/primary care provider
- Use sterile pre-packaged collection and transport system
- Do not allow transport medium to freeze or become overheated in your car before using it.
- If both anaerobic and aerobic cultures are desired, ensure that the swab kit has this capability and that you have requested both tests in the lab requisition

Procedure
- Thoroughly rinse wound with normal saline (non-bacteriostatic).
- If this is a cavity wound and you will be sampling tissue at the bottom of the cavity, blot any excess NS with a sterile gauze to prevent dilution of the sample.
- If the wound is quite dry you should pre-moisten the swab in the culture medium before pressing on the tissue.

Procedure
- Don't swab:
  - pus
  - exudate
  - hard eschar
  - necrotic tissue
- Results will only show what is on the surface, not what is actually in the live (viable) tissue

Procedure
- Prepare the client/patient for momentary discomfort
- Rotate the swab tip in a 1 cm square area of clean granulation tissue x 5 seconds, using gentle pressure to release tissue exudate

Procedure
- Follow hospital or institutional practices for getting the swab to the lab.
- DO NOT REFRIGERATE!
- In the community sector, the patient or their family/care providers should transport the specimen to the laboratory at room temperature within 24 hours.
- Within one hour is ideal… the sooner the better.
Assessment and Evaluation of Response to Treatment (page 2) for Infections

- If there are clinical indications for use of an antimicrobial dressing, carry out a two week challenge.
- At each dressing change, reassess the wound for signs of NERDS/STONEES/PAIN etc.
- If there are still signs of localized infection, continue with topical treatment for another two weeks.
- **If there are ongoing signs and symptoms of spreading infection, or the infection does not seem to be responding to antibiotic therapy, communicate with the physician or primary care provider immediately and directly** to have systemic antibiotics reassessed/continued or changed and document action regarding this.
- **IF at any point, signs and symptoms of SYSTEMIC INFECTION are present, this can be life-threatening and needs immediate medical attention.**
- When the signs and symptoms are resolved, you should STOP the antimicrobial dressings, but continue the systemic (ORAL OR IV) antibiotics until the course is completed.
- If patients are on antimicrobial dressings for longer than a four week period, review the dressing regimen and consider referral to appropriate clinical specialist e.g. ET, Nurse or Physician Wound Care Specialist, or Specialist Podiatrist for further discussion on management plan.

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