CARE OF THE WOUND BED
ASSESSMENT AND MANAGEMENT ALGORITHM

TREAT THE CAUSE	**TREAT PATIENT CONCERNS**	**TREAT THE WOUND**

Refer to:
• Recommendations for Venous leg ulcers
• Recommendations for Arterial ulcers
• Recommendations for Pressure ulcers
• Recommendations for Diabetic foot ulcers
	• Manage pain
	• Provide emotional support
	• Assess and consider financial situation
	• Provide patient and family education
	• Assess and provide/facilitate optimum health care
		• Determine potential for healing
		• Assess the wound
		  • Obtain the wound history
		  • Assess and monitor the physical characteristics of the wound
		  • Assess and manage wound pain
		• Local Wound Care
		  • Cleanse the wound
		  • Debride the wound
		  • Assess the wound for ***critical colonization*** and/or ***infection***
		  • Select appropriate wound dressing to provide moisture balance
		  • Evaluate the expected rate of wound healing to determine if treatment is optimal

PREPARATION OF THE WOUND BED ASSESSMENT AND MANAGEMENT

INTRODUCTION

Preparing the wound bed involves a holistic and systematic approach to the promotion of wound care. This concept involves the assessment and appropriate management of the cause, as well as systemic and local factors that may delay healing. Preparing the wound bed also addresses the assessment and treatment of patient-centered concerns and the wound itself. This guideline will focus on assessment and management of the wound.

DETERMINE THE POTENTIAL FOR HEALING

Assess the patient and the wound to determine the potential for healing

Blood supply

- assess and determine if the wound has adequate blood supply to heal. This is especially important for wounds involving the lower extremities

- if there is NO potential for healing due to inadequate blood supply, moist interactive local wound care is contraindicated. The application of topical antiseptics to dry the wound and prevent bacterial invasion is recommended

  (Refer to sections for pressure ulcers, venous and arterial ulcers, diabetic foot ulcers and malignant wounds)

Host factors

- assess and optimally manage risk factors and co-morbidities that may affect wound healing such as:
  - drugs i.e. immunosuppressive agents and systemic steroids
  - ***periwound*** edema in a chronic wound
  - serum albumin
    - below 30g/L delays healing
    - below 20g/L very hard to heal or non-healing wounds (refer to pressure ulcer section)
  - hemoglobin
    - below 100g/L delayed healing
    - below/= 70-80g/L very hard to heal or non-healing wounds
  - diseases or treatments that impair immunity such as rheumatoid arthritis and collagen vascular diseases (lupus, scleroderma, dermatomyositis), chemotherapy and radiation therapy
  - chronic diseases such as diabetes, hepatic/renal/lung disease and vascular disease

Note: This list is not inclusive.

If the overall goal for the client is palliation or maintenance of current health status, the wound care goals are to prevent further deterioration and complications, alleviate pain and improve the quality of life.

ASSESS THE WOUND

Common parameters evaluated are wound history, location, size including presence or absence of ***undermining*** and ***tunneling***, degree of tissue damage, wound bed appearance, ***exudate***, wound margins and ***periwound*** skin. Conducting initial and ongoing assessments of the wound is needed to monitor healing and direct appropriate management. Documentation in the patient record is needed to ensure continuity of patient care.

Wound History

- obtain the following information:
  - previous wounds/ulcers, treatment provided and response to treatment
  - duration of current wound/ulcer
  - previous and current prevention and treatment strategies used

Wound Location

- identify the location of the wound using a body diagram and/or description of anatomical location and document

Wound Size

- reduction or increase in wound surface area and/or depth is an indicator of healing or lack of healing.
- wounds can be measured using the following methods:
  - disposable ruler to measure length and width (Figure # 1 and #2)

Figure #1

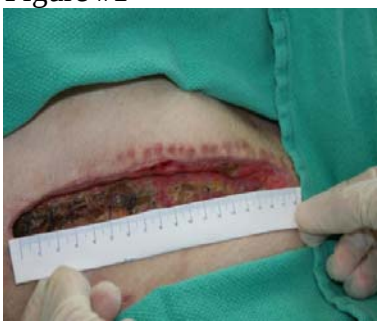
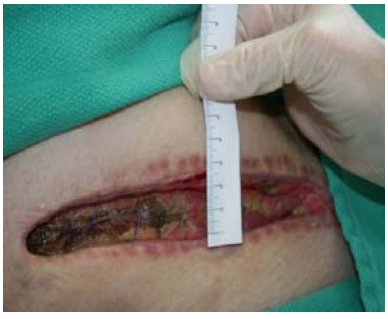


Figure #2



  - acetate tracings to measure the circumference
  - computerized wound measuring systems, digital photography or digitizing systems are available
- measure wound depth with a sterile probe (surgical instrument or cotton tipped applicator). Place the probe in the deepest part of the wound and use a gloved

finger to mark the depth at the skin surface. This distance is measured against a ruler. (Figure # 3 and #4). Measuring the depth helps to determine if the wound extends to bone.

Figure #3

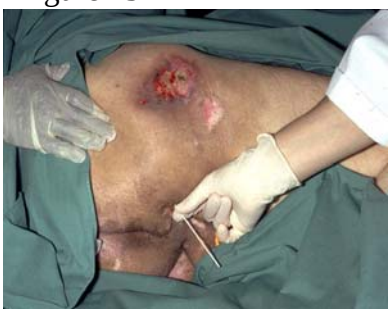
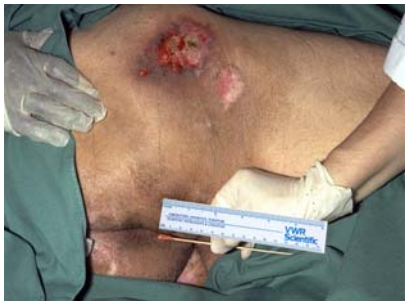


Figure #4



- assess for ***tunneling*** and ***undermining*** by placing a cotton tipped applicator or sterile probe along the wound edge and insert into the dead space until resistance is met or entire applicator is inserted (Figure #5, #6 and #7). When ***undermining*** is present, the direction (using the clock method) and extent (measured in cms) should be documented. For example: 2 cm. undermining present from 6 to 9 o'clock.

Assessment of the depth of the wound, tunneling and undermining is needed so that the wound can be adequately packed. The dead space needs to be completely filled to avoid abscess formation by premature closure of the wound. To avoid tissue death and discomfort for the patient, the dead space should be "lightly' packed. Documenting the extent of the depth, tunneling or undermining guides the clinician to know approximately how much packing material is needed with each dressing change.

The dressing material selected for packing depends on the amount of drainage and extent of depth, tunneling or undermining. Strip gauze packing is used to fill narrow areas (such as tunneling) or mildly exudative wounds. When using any type of strip or rope packing, **one continuous length of packing** must be used with one end of the packing left out of the wound to ensure complete removal of the packing takes place. For large deep exudative wounds, an absorbent dressing may be more suitable such as a calcium alginate or hydrofiber rope but only if the entire wound base is visible. If the entire wound base is not visible, a calcium alginate or non-reinforced hydrofibre must not be used as there is an increased risk of the dressing being left in the wound.

Figure #5 Figure #6 Figure #7

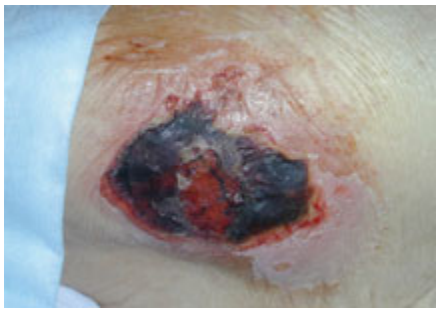
Degree of Tissue Damage

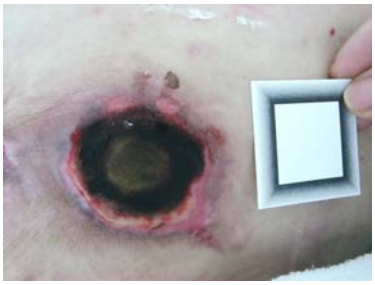
- **Pressure Ulcer Staging:** Refer to recommendations for pressure ulcers
- **Partial or Full Thickness:** This method of staging may be used for all wounds including pressure ulcers
  - partial thickness wounds are confined to the ***epidermis*** and ***dermis*** (blisters, abrasions, superficial injuries)
  - full thickness wounds involve tissue loss extending through the ***dermis*** and into the ***subcutaneous*** tissue with or without muscle or bone exposure

Wound Bed Appearance

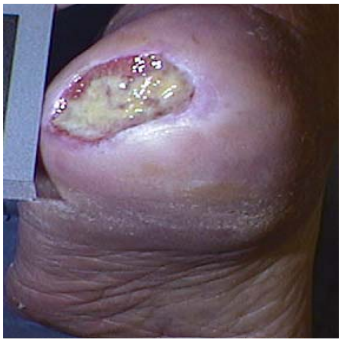
- assess and document according to the tissue type and or color present.

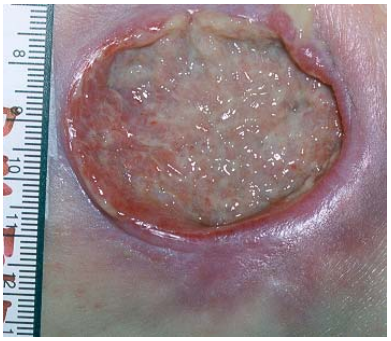
  - **Black Necrotic Tissue / *Eschar***
    Nonviable tissue that may be soft and moist or firm and dry.





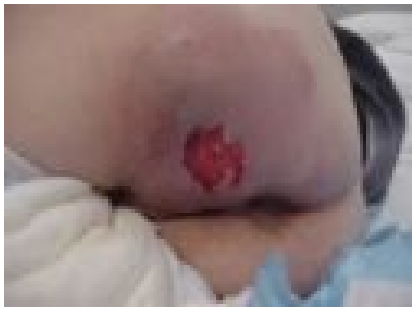
  - **Yellow Necrotic Tissue / *Slough***
    Nonviable tissue that may be soft or firm.

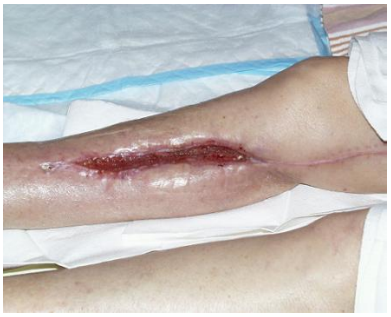




Note: A firm yellow base may indicate underlying structures (i.e. tendons or ligaments) and should not be debrided.

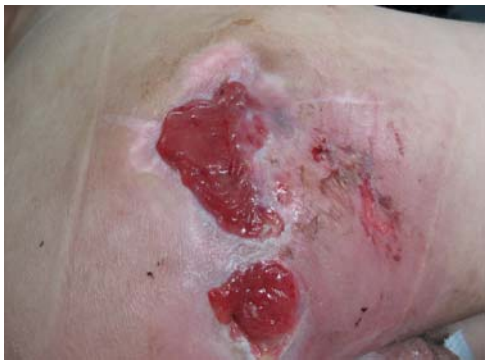
  - **Red-Pink Tissue (*granulation*)**
    Healthy ***granulation*** tissue is usually a red-pink color, firm and moist.



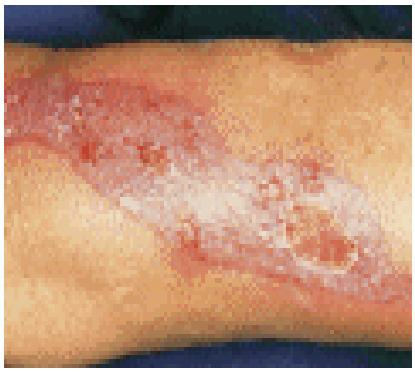


With increased ***bacterial burden*** or ***infection***, ***granulation*** tissue may become darker, ***friable***, malodorous, and may have patches of greenish or yellow discoloration. ***Hypergranulation*** tissue may also be present.

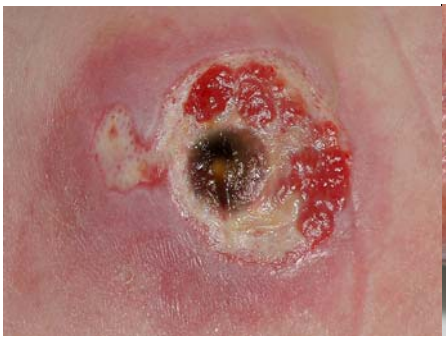
- ***Hypergranulation*** Tissue
  Typically bright red ***friable*** tissue and bulges out of an ulcer. It may require removal to facilitate ***re-epithelialization***.



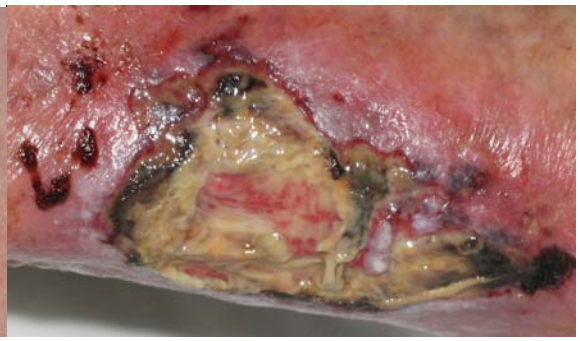
- **Pink, Purple Tissue / Epithelial**
  Viable tissue that is fragile. It usually starts to appear at the edges of a granulated wound, but may also occur as islands in the center of a wound.



- **Percentages of Tissue in Wound Bed**
  The amount of each type of tissue present in the wound bed (i.e. black, yellow, red) can be documented in percentages



approximately 25% black, 35% yellow, 40% red



approximately 20% black, 65% yellow, 15% red

Wound *Exudate*

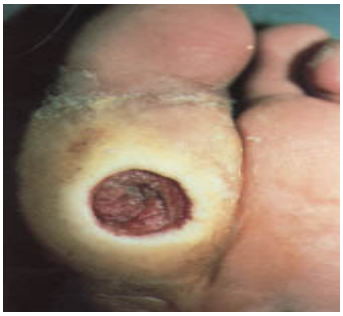
- assess ***exudate*** relative to:
  - **Quantity** – e.g. scant, moderate, copious. Documentation of the frequency of dressing changes can help indicate quantity of ***exudate***
  - **Color** – clear, ***serous***, ***sanguinous***, purulent or a combination of these (e.g. ***serosanguinous***)
  - **Odor -** present /absent

Note: Heavy ***exudate*** should alert clinicians to problems related to the underlying cause or an early sign that there may be increased ***bacterial burden*** or infection.

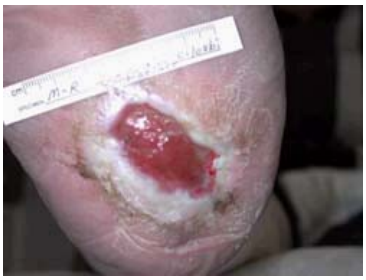
Wound Margins and Surrounding Skin

- abnormalities may indicate actual or potential wound deterioration. Assess and document (in centimeters) the presence of the following:

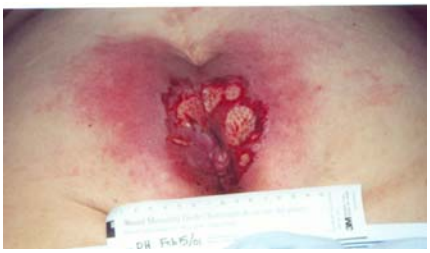
  - **Hyperkeratotic (thick) callus**
    This abnormally thick or hard area of skin can lead to increased local pressure especially when present on the plantar aspect of the foot. It is important to remove this type of callus.



- ***Maceration***
  Excessive moisture occurs when the dressing is not absorbing ***exudate*** adequately and/or when there is limb edema, increased pressure or infection.



- ***Erythema***
  May be due to inflammation, infection, Stage 1 pressure ulcer (refer to recommendations for pressure ulcers), venous or arterial disease (refer to recommendations for venous and arterial ulcers).



- ***Induration***
  Hardening or thickening of tissue may be due to inflammation, infection, or accumulation of blood.

- **Edema**
  May indicate infection or pressure induced tissue trauma.

CLEANSE THE WOUND

Wound cleansing facilitates healing by removing ***exudate*** and necrotic tissue and by reducing ***bacterial burden***.

- cleanse wound with sterile water or low-toxicity solutions (such as normal saline or a commercially prepared wound cleanser)
- gently irrigate with 100-150 ml of solution
- use fluid that is at least at room temperature for cleansing. (Colder solutions can slow down cellular repair)
- cleanse wound at each dressing change
- do not use skin cleansers or antiseptic agents (e.g. povidone iodine, sodium hypochlorite solution, hydrogen peroxide, acetic acid) to clean wounds

Note: Topical ***antiseptic*** solutions should be reserved for wounds that are non-healable (e.g. povidone iodine) or those in which the local ***bacterial burden*** is a greater concern than the stimulation of healing (e.g. aqueous chlorhexadine 0.05%).

Methods of Cleansing

Use enough irrigation pressure to enhance wound cleansing without causing trauma to the wound bed. Safe and effective wound irrigation pressures range from 4-15 pounds per square inch (psi).

- **Method 1**
  - irrigate wound with a 30 ml syringe and an 18 or 20 gauge venous access device (i.e. angiocath) held 4-6 inches from the wound bed. (The use of an angiocath rather than a needle is suggested to reduce the danger from needle stick injuries.) A mask with eye protection and a gown is recommended to protect against splash-back; this method exerts about 15 psi and is used for wounds that:
    - have moderate/copious ***exudate***
    - contain ***slough*** or ***eschar*** (necrotic tissue)
    - are ***critically colonized*** or infected
    - have increased depth and/or ***tunneling*** or ***undermining***
- **Method 2**
  - irrigate wound with a single-use 100 ml squeeze bottle of saline or water; this method exerts approximately 4 psi of pressure and is used for wounds that:
    - are shallow
    - have minimal ***exudate***
    - have little or no ***slough*** or ***eschar*** (necrotic tissue)
    - are not ***critically colonized*** or ***infected***
- **Method 3**
  - irrigate wound with a commercially prepared low toxicity spray wound cleanser (follow manufacturers' instructions)
  - commercially prepared wound cleansers contain surfactants which may facilitate the removal of adherent material from the wound bed
- **Method 4**
  - soak or compress wound with a moist saline gauze
  - may be done after irrigation & prior to application of a new dressing for additional cleansing and loosening wound debris

DEBRIDE THE WOUND

The removal of necrotic tissue and foreign material by the process of ***debridement*** is one of the most important factors in the management of chronic wounds.

- The presence of necrotic tissue in the wound bed:
  - increases the risk for infection and increases bacterial concentration by providing a medium for bacterial growth
  - increases metabolic demand as the body attempts to remove the necrotic tissue
  - compromises restoration of the structure and function of the skin
  - slows or prevents wound healing (i.e. ***granulation***, ***epithelialization*** and contraction of wound edges)
  - causes protein loss through wound drainage
  - interferes with assessment of actual wound depth
  - causes odour management issues
  - increases potential for delayed healing and ***hypertrophic scarring*** in burn wounds

- Select the method of ***debridement*** most appropriate to:
  - patient condition and treatment goals
  - type, quantity, depth and location of necrotic tissue
  - caregiver and patient preference

- Do not debride when:
  - there is no necrotic tissue in the wound bed
  - the goal for the patient is maintenance of the status of the ulcer, while providing comfort and preventing infection
  - there is dry gangrene and/or inadequate blood supply (consult physician)
  - when the affected limb is pulseless or has an abnormal ***Ankle Brachial Index*** (consult physician). Refer to recommendations for arterial ulcers and diabetic foot ulcers

Note: Vascular assessment is recommended for ulcers in lower extremities prior to ***debridement*** to rule out arterial vascular compromise

Debridement techniques may be considered along a continuum from least invasive (i.e. simple irrigation) to most invasive (i.e. sharp/surgical).

- types of ***debridement*** include: autolytic, enzymatic, surgical/sharp and mechanical
- several ***debridement*** techniques may be utilized to complete the removal of necrotic tissue from a wound
- selective ***debridement*** techniques include autolytic, enzymatic, and sharp/surgical as they only remove necrotic tissue

- mechanical ***debridement*** is non-selective because both healthy ***granulation tissue*** and necrotic tissue are removed

Methods of *Debridement*

- **Autolytic *Debridement* (Selective)**
  - the most common type of ***debridement***
  - used for partial and full thickness wounds and for stage 2, 3, & 4 pressure ulcers with small to moderate amounts of ***exudate***
  - slower form of ***debridement***
  - usually painless
  - utilizes dressings (transparent films, hydrocolloids, hydrogels) to keep the wound bed moist

Note: Do not use occlusive dressings on infected wounds.

- **Enzymatic *Debridement* (Selective)**
  - useful for removal of necrotic tissue when sharp ***debridement*** cannot be utilized
  - utilizes proteolytic enzymes to break down necrotic tissue
  - slower and less aggressive than sharp ***debridement***
  - prescription is needed for enzymatic debriding agents
  - may be facilitated by cross-hatching or scoring hard ***eschar*** prior to application of the enzyme
  - may result in excessive ***exudate***, local irritation to surrounding skin and possible infection

- **Sharp (Surgical) *Debridement* (Selective)**
  - fastest and most effective method of ***debridement***
  - effective for wounds with moderate to large amounts of necrotic tissue when the goal is healing
  - larger wounds with purulent drainage, deep infection, advancing ***cellulitis***/sepsis or a large area of necrotic tissue may require surgical ***debridement*** in an operating room setting
  - small wounds may be sharply debrided at the hospital bedside, in the community setting or in the physician's office
  - cleanse prior to ***debridement*** and use sterile instruments
  - wound debris is cut away using a scalpel, scissors or curette
  - generally performed by physicians or by trained health care professionals in approved care settings. Clinicians must ensure that:
    - they have the necessary skills to perform the task
    - the skill is within their scope of practice
    - there is agency or institutional policy in place to support them
  - the procedure may be painful when debriding to a bleeding base, therefore, pain control measures should be implemented prior to the procedure

- **Mechanical *Debridement* (Non-Selective)**
  - physically removes debris from the wound

    - **Wet to Dry Gauze Dressings**
      - place saline soaked gauze on wound and allow it to dry
      - remove the dry dressing from the wound bed
      - removes both viable and non-viable tissue that has become attached to the gauze
      - change dressing 2-4 times a day
      - discontinue when necrotic tissue has been removed

Note: This method of wound debridement causes pain, is labor intensive and costly

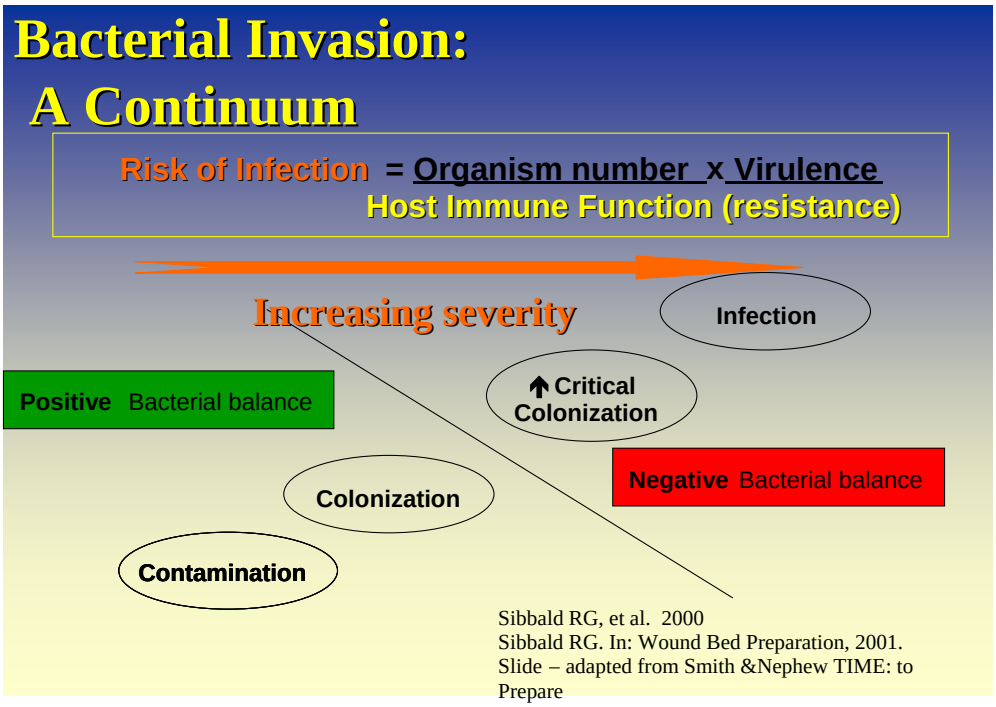
    - **Wound Irrigation**
      - a safe and effective form of mechanical ***debridement***
      - used in combination with other types of ***debridement***
      - described on p.17 in Wound Cleansing Section

    - **Biological *Debridement***
      - sterile larvae of the Greenbottle fly are used to remove necrotic tissue from the wound bed
      - although recent studies support the use of this ***debridement*** method, it has not yet become generally accepted in Canada

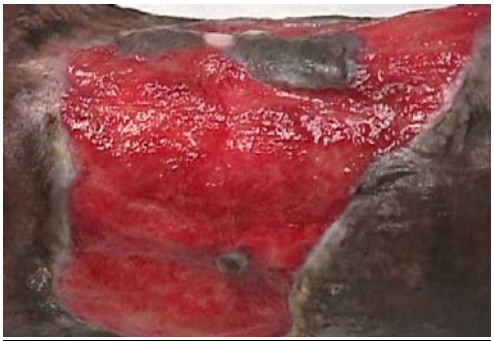
ASSESS AND TREAT THE WOUND FOR CRITICAL COLONIZATION OR INFECTION

Bacteria in Chronic Wounds

- Many wounds contain bacteria at levels ranging from ***contamination***, ***colonization***, ***critical colonization*** and ***infection.***



- ***Contamination***: the presence of bacteria on the wound surface, not causing any injury to the host.
- ***Colonization***: the presence of replicating bacteria attached to the wound tissue, not causing any injury to the host.
- ***Critical Colonization*** (also known as increased ***bacterial burden*** or occult or covert infection): occurs when bacteria delay or stop wound healing without the presence of classic signs and symptoms of infection (i.e. pain, ***erythema***, edema, purulent discharge, and increased warmth. Refer to Table 2 p. 25).



- ***Infection*:** involves the presence of replicating micro-organisms in a wound with associated host injury. Invasion of the micro-organisms into the host tissues produces various local and systemic responses
(Refer to Table 2 p. 25).

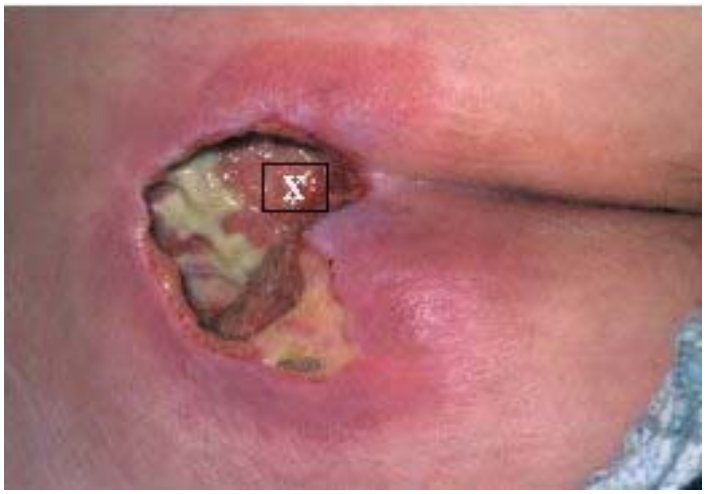
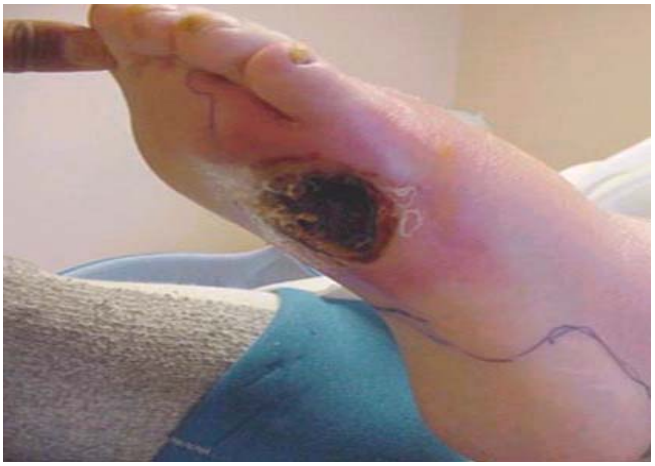


photo used with permission from Dr. R. Kohr, www.lhsc.on.ca/wound



- Clinical assessment of the wound is necessary to distinguish between ***critical colonization*** from ***infection***.

Risk Factors for *Critical Colonization* and *Infection*

- The possibility of a wound becoming infected is related to: the type of micro-organisms, and the ability of the host (patient) to resist infection.

$$\text{Infection} = \frac{\text{Number of different types of organisms } \mathbf{x} \text{ Virulence}}{\text{Host Resistance}}$$

- The presence of local and systemic factors affecting host resistance (immune response) is often the critical factor in determining whether ***infection*** will develop. (Refer to Table 1)

Table 1

Local Risk Factors for *Critical Colonization* or *Infection*	**Systemic Risk Factors for *Critical Colonization* or *Infection* (Host Resistance)**
Large wound area	Vascular disease
Deep wound	Edema
High degree of chronicity	Malnutrition
Anatomic location (e.g. anal region)	Diabetes mellitus
Presence of foreign bodies	Smoking/ Drug and Alcohol abuse
Presence of necrotic tissue	Prior surgery/ Radiotherapy/Chemotherapy
Mechanism of injury (e.g. contaminated penetrating objects)	Medications such as corticosteroids, and other immunosuppressants
High degree of contamination	Inherited neutrophil defects
Reduced tissue perfusion	Immune deficient conditions i.e. Rheumatoid arthritis

Adapted from Sibbald R. G. et al., 2003.

Note: ***Antibiotic*** resistant organisms increase the risk of serious infections.

Assess and Treat the Wound for *Critical Colonization* or *Infection*

- chronic wounds should show evidence of healing within four weeks and progress to healing by week 12. If this time is exceeded, ***critical colonization*** or ***infection*** should be suspected as one of the causes of delayed healing
- the diagnosis of ***critical colonization*** and ***infection*** is primarily based on clinical criteria (Refer to Table 2 p. 25)

Clinical Signs and Symptoms of *Critical Colonization* and *Infection* in Chronic Wounds

Table 2

Critical Colonization **(superficial *infection*)**	⇒	Deep Wound ***Infection*** **(include signs and symptoms of *Critical Colonization*) and ⇓**	⇒	**Systemic Infection (include signs and symptoms of *Critical Colonization* and Deep Wound *Infection*) and ⇓**
Non-healing/delayed healing		Increasing pain		Fever Delirium (if elderly)
Discolored ***granulation*** tissue - Bright red - Dull with patches of greenish or yellow discoloration NOTE: Healthy ***granulation*** tissue is pink-red and moist with a translucent appearance	⇒	Swelling, ***induration***, edema	⇒	Rigors/Chills
Friable (bleeds easily) and/or exuberant ***granulation*** tissue	⇒	***Erythema*** – ≥ 2 cm beyond wound margin	⇒	Hypotension
New areas of breakdown or necrosis on the wound surface (***slough***)		Increased temperature – ≥ 2 cm beyond wound margin		Multiple organ failure
Increased ***exudate*** that may be ***serous*** before becoming purulent Foul odour	⇒	Wound breakdown - Increase in size or new areas of breakdown, ***undermining*** or probing to bone	⇒	

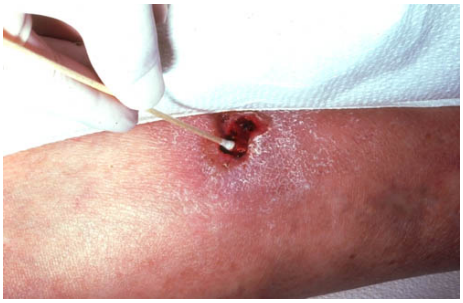
Adapted from Sibbald et al., 2001

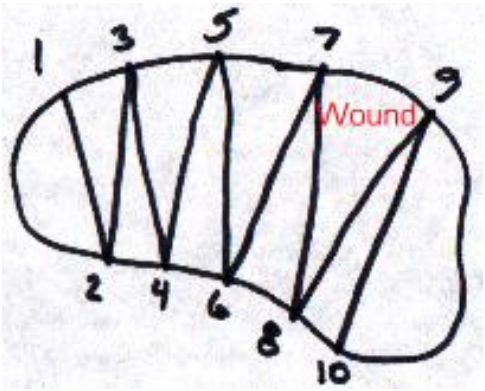
- in addition to clinical assessment, bacterial swabs or deep cultures, laboratory and radiological tests are used in the diagnosis and treatment of wound infections
- obtain a wound culture if the wound exhibits clinical signs and symptoms of ***infection*** and/or if the wound is not healing despite optimum care. Tissue from the ***debridement*** process or abscess fluid collected with a needle and syringe can also be cultured

Note: Do not use positive wound cultures alone to diagnose wound infections.

Guidelines for Obtaining a Wound Culture

1. If necessary, superficially debride area before swab collection
2. Thoroughly irrigate wound with sterile normal saline or sterile water prior to swab collection NOTE: Do not swab superficial ***eschar***, pus, or ***exudate***
3. Use appropriate sterile swab and culture medium
4. For wounds smaller than 5 cm^2, using the side of the swab tip; roll it for one full rotation over the ***granulation*** tissue that has the most obvious signs of infection (avoid ***slough*** and surface purulent discharge) For wounds larger than 5 cm^2 rotate swab over wound surface using a zigzag pattern. Place swab into transport medium
5. Request aerobic and anaerobic analysis
6. Transport to laboratory





Prevention of *Critical Colonization* and *Infection*

For prevention of ***critical colonization*** and ***infection*** refer to Appendix A.

- For treatment of critically colonized and infected wounds, identify and optimally manage the underlying risk factors/causes (local and systemic). (Refer to recommendations for pressure ulcers, venous and arterial ulcers, diabetic ulcers, and malignant wounds.)
    - Healable wound with evidence of ***critical colonization*** or delayed healing with no evidence of deep ***infection***:
        - provide adequate wound and ***periwound*** cleansing
        - debride wound if needed; this produces a rapid reduction in ***bacterial burden***
        - consider a two week trial of topical ***antimicrobials*** (Refer to Table 3)
        - wound ***antiseptics*** that are non-cytotoxic may be useful in reducing ***bacterial burden*** in the wound

- topical ***antibiotic*** therapy should be used only for mild infections without significant tissue invasion. If used too liberally and for too long a period of time, ***antimicrobial*** resistance, contact dermatitis and ***sensitization*** may occur
- provide moisture balance

Note: If the wound fails to improve, perform wound cultures and evaluate for ***osteomyelitis***.

- Healable wound with evidence of deep ***infection*** or if the wound fails to show signs of healing within 2 weeks with topical ***antimicrobials***
  - provide adequate wound and ***periwound*** cleansing
  - debride wound if needed; this produces a rapid reduction in ***bacterial burden***
  - consider application of topical ***antimicrobials*** (Refer to Table 3)
  - provide moisture balance
  - perform wound swab cultures and evaluate for ***osteomyelitis***
    - select systemic ***antibiotics*** (oral or parenteral) based on culture sensitivities

Note: The potential for development of bacteremia and sepsis is greater if the wound is critically colonized or ***infected***. Careful ongoing assessment and appropriate management of the wound is required.

- Non-healable wound with evidence of ***critical colonization***
  - an ***antiseptic*** such as povidone iodine should be used to stabilize the wound and limit bacterial growth

- Non-healable wound with evidence of deep ***infection***
  - an ***antiseptic*** such as povidone iodine should be used to stabilize the wound and limit bacterial growth
  - systemic ***antibiotics*** may be indicated

Note: An Infection Control Practitioner should be involved if ***antibiotic*** resistant organisms are present in the wound. An Infection Control Practitioner is needed to reduce the transmission of Health-Care-Associated Methicillin-resistant Staphylococcus aureus (HA-MRSA), as well as Community Associated MRSA (CA-MRSA).

Topical *Antimicrobial* Indicated in Wounds with *Critical Colonization* and *Infection*

Table 3

AGENT	S. AUREUS	MRSA	STREPTOCOCCUS	PSEUDOMONAS	ANAERABES	COMMENTS	Summary
Cadexomer iodine (***antiseptic***)	+	+	+	+	+	Also debride. Low potential for resistance. Caution with thyroid & kidney disease	Low risk and effective
Silver (***antiseptic***)	+	+	+	+	+	Do not use with saline. Low potential or resistance	
Silver sulfadiazine (***antibiotic***)	+	+	+	+	+	Caution with sulphonamide sensitivity	
Polymyxin B Sulphate/Bacitracin zinc (***antibiotic***)	+	+	+	+	+	Bacitracin in the ointment is an allergen; the cream formulation contains the less-sensitizing gramicidin	Use selectively
Mupirocin (***antibiotic***)		+				Reserve for MRSA and other resistant Gram+ species	
Metronidazole (***antibiotic***)					+	Reserve for anaerobes and odour control. Low or no resistance of (< 2%) of anaerobes despite systemic use.	
Benzoyl peroxide (***antiseptic***)	Weak	Weak	Weak		Weak	Large wounds. Can cause irritation and allergy.	
Gentamicin (***antibiotic***)	+		+	+		Reserve for oral/IV use-topical use may promote resistance.	Use with caution
Fusidin ointment (***antibiotic***)	+		+			Contains lanolin (except in the cream)	
Polymyxin B Sulphate/Bacitracin zinc neomycin (***antibiotic***)	+	+	+	+	+	Neomycin component causes allergies, and possibly cross-sensitizes to aminoglycosides.	

Adapted from Sibbald R.G. et al., 2006

Osteomyelitis

The risk for ***osteomyelitis*** is directly proportional to the depth of the soft tissue intervening between skin and bone.

- if an ulcer probes to bone, or when the ulcer is suspected of extending to bone, ostoemyelitis should be ruled out
- diagnosis can be made with:
    - x-ray (repeat in 2 weeks)
    - Erythrocyte Sedimentation Rate (ESR) can be normal in patients with ***osteomyelitis*** therefore this test may be of more value in monitoring patients rather than diagnosing
    - bone scan (if X-ray/ESR inconclusive)
    - MRI (if X-ray/ESR/bone scan inconclusive)

Note: Acute ***osteomyelitis*** may be present despite a normal radiograph.

- treatment:
    - when possible, a referral to an infectious diseases physician should be made
    - long term ***antimicrobial*** therapy is required
    - bone biopsy/***debridement*** may be required

MANAGEMENT OF WOUND PAIN

The approach to pain management is an individualized plan of care for each person. Caring for the individual with pain involves careful assessment of the wound and the pain. It is important to identify the impact the pain is having on the person's activities of daily living (ADL's), Quality of life (QOL) and sleep patterns. The goal of care should be to reach the person's acceptable pain level through a comprehensive pain management plan.

Assessment and Documentation of Pain

- assess type, cause, intensity (visual faces or numerical rating scale) and frequency
- document on a pain diary/form and the patient record

Types of Wound Pain

Wound pain can be classified according to etiology and type (neuropathic & nociceptive) and according to duration (acute versus chronic).

- **Nociceptive pain**
  An inflammatory response to tissue damage, identified trigger or stimulus. Nociceptive pain resolves when the tissue damage stops and the inflammation subsides. Patients describe the pain as sharp, stabbing, aching & throbbing.
- **Neuropathic pain**
  The persistent injury to the peripheral or central nerve receptors and produces a pain that tends to be more chronic in nature. Patients describe the pain as burning, stinging, and tingling.

Causes and Characteristics of Pain

Causes of Pain	Characteristics
Background Pain	Pain at rest (related to wound etiology, infection, ischemia)
Incident Pain	Pain during day-to-day activities (coughing, friction, dressing slippage)
Procedural Pain	Pain from routine procedures (dressing removal, application)
Operative Pain	Pain associated with an intervention that would require an anesthetic (cutting of tissue or prolonged manipulation)

Management of Wound Pain

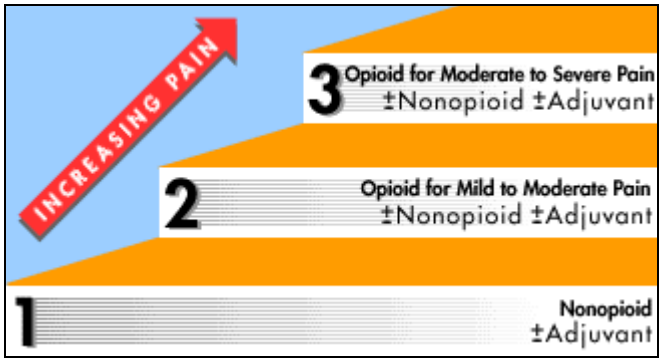
- allow the patient "time outs" if it becomes too painful for them during a dressing change. This gives the patient some control over their wound care regime
- avoid topical agents that cause pain
- manage the cause of the pain (e.g. Pressure = therapeutic support surfaces)
- select dressings that will provide optimal moisture balance for the wound and to prevent adherence and trauma
- protect the ***periwound*** skin (e.g. skin protectors & skin barriers)
- select ***debridement*** options appropriately; provide analgesia as needed
- manage ***infection*** and edema
- provide emotional support
- utilize relaxation therapies to help relieve pain and the perception of pain. (e.g. deep-breathing, calming voice, therapeutic touch, distraction, & informing the patient of the plan of care)
- provide analgesia using the World Health Organization (WHO) pain ladder (topical and/or systemic approach as appropriate). The WHO ladder does not take into account neuropathic pain.

Anticonvulsants/Tricyclics – neuropathic pain

- **Antidepressants** – neuropathic pain
- **Opioids** – moderate to severe nociceptive pain
- **Non Steroidal Anti-inflammatory (NSAIDS)** - mild to moderate nociceptive pain.

Note: Scheduled analgesics are essential in the effective management of chronic nociceptive pain.

The World Health Organization (WHO) Pain Ladder



ADVANCED WOUND BED PREPARATION

- implementation of these recommendations is made by an Advanced Wound Care Clinician/Physician
- the wound must be continually monitored and outcomes measured under the direction of the Advanced Wound Care Clinician/Physician
- refer back to the section on Treat the Cause when healing is not progressing

Advanced Wound Care Therapies

- **Negative Pressure Therapy** (subatmospheric pressure)
    - is delivered to the wound to promote wound healing
    - helps to remove excess fluid, increase vascularity, contract wound edges and decrease ***colonization***
    - patients who are not a candidate for surgery may be suitable for negative pressure therapy, as well as surgical patients as an adjunctive therapy
    - indications for Negative Pressure Therapy:
        - cavity wounds
        - grafts
        - flaps
        - partial-thickness burns
        - dehisced wounds
        - chronic wounds
        - acute wounds
        - traumatic wounds
        - pressure ulcers
        - diabetic ulcers
    - contraindications for Negative Pressure Therapy:
        - malignancy in the wound
        - untreated ***osteomyelitis***
        - non-enteric and/or unexplored fistula
        - necrotic tissue with ***eschar*** present

Note: Do not use negative pressure therapy on exposed blood vessels or organs

Precautions

- wounds with active bleeding or problems with ***hemostasis*** must be addressed before negative pressure therapy is utilized
- if a wound has a problem with ***hemostasis*** and/or if the patient is taking anticoagulants, negative pressure therapy should be delayed p until ***hemostasis*** is achieved
- when treating a wound with negative pressure therapy be aware of the device's proximity to blood vessels. Use negative pressure therapy with caution when the wound is adjacent to large blood vessels. Avoid placing the foam dressing directly over these vessels

- **Bioengineered Skin**
    - bioengineered skin products or living skin equivalents are used in the treatment of acute and chronic wounds
    - may contain living human cells, such as fibroblasts or keratinocytes or both, that produce the same collagen, proteins and growth factors found in healing skin
    - replaces and rebuilds damaged tissue in the wound or ulcer and promotes healing
    - may work by delivering living cells, which are said to be "smart" in engineering terms and thus, capable of adapting to their environment
    - indications for use are diabetic foot ulcers and some chronic wounds such as venous leg ulcers

- **Growth Factors**
    - growth factors are used to accelerate the healing of chronic wounds
    - platelet derived growth factor **(PDGF)** is the only topically applied growth factor that is commercially approved for use
    - PDGF has been shown to accelerate the healing of neuropathic diabetic foot ulcers
    - the effectiveness of PDGF is significantly increased with the utilization of the principles of wound bed preparation with an aggressive approach to surgical ***debridement*** prior to application

- **Protease-modulating Matrix Dressing**
    - a protease modulating matrix dressing is made with collagen and oxidized regenerated cellulose
    - it binds proteases which, when present in excess, are a major barrier to healing. This also results in the increased availability of growth factors in the wound.
    - have been found to be useful in venous and diabetic ulcers

- **Skin Grafts**
    - are used in advanced wound care therapy and care is provided under the direction of the Advanced Wound Care physician
    - are pieces of skin that have been severed from their local blood supply and transplanted to another site
    - Types of skin grafts
        - **Full Thickness Skin Grafts**
            - composed of the ***epidermis*** and full thickness ***dermis***
            - commonly used to repair facial defects resulting from removal of skin cancers
            - may be used on virtually any site, as long as the recipient bed has a sufficiently rich vascular supply

- **Split Thickness Skin Grafts**
    - composed of ***epidermis*** and partial thickness ***dermis***
    - are used to repair large defects, including those that cannot be covered by a flap or would heal too slowly by secondary intention
- **Composite Grafts**
    - composed of at least 2 tissue types, usually skin & cartilage
    - are modified full thickness grafts, used to repair small facial defects (<1cm)
- **Free Cartilage Grafts**
    - cartilage with its overlying perichondrium are used to restore the architecture of a site that has undergone significant cartilage loss, such as the nasal ala, nasal tip, sidewall, ear or the eyelid
    - free cartilage grafts may be used in conjunction with flaps or full thickness skin grafts to maintain airway patency and to minimize the risk of alar retraction during wound healing

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