Developed by the British Columbia Provincial Nursing Skin & Wound Committee in collaboration with NSWOC/Wound Clinicians from:

Title	**Guideline: Assessment, Prevention & Treatment of Wound Infection**
Document Indications for Use	This guideline is intended for acute and chronic wounds with suspected, or diagnosed, local infection, or spreading infection. This guideline is not intended for infected closed incisions nor the systemic treatment for sepsis.
Practice Level	• Nurses may take a culture and susceptibility swab (C&S) for suspected wound infection without a Physician's order if this activity is within the nurse's scope of practice and is supported by health authority/agency policy. • Swabs are to be taken in accordance to the C&S Procedure to ensure good quality. • Clients (see Definitions) with an actual or suspected wound infection require an interprofessional approach to provide comprehensive, evidence-based assessment and treatment. This clinical guideline focuses solely on the nurses' role as one member of the interprofessional team providing client care.
Background	• All wounds contain microbes, however the likelihood of a wound becoming infected is related to the number and virulence (ability of microbes to damage the host) of the microorganisms and the ability of the client (host) to resist infection. • In addition to the mechanism or cause of the wound e.g., a traumatic injury, the following may increase the risk for the development of an infection; the client's health behaviors e.g., compromised nutritional status, personal hygiene, and their clinical condition(s); poor vascular status, poor tissue perfusion, compromised nutritional status, localized edema, smoking, substance use, co-morbid diseases such as diabetes mellitus, immunocompromise conditions and taking medications that compromise the immune system. The amount of necrotic tissue/slough in the wound and the length of time the wound is open, also contribute to risk of a wound infection developing. • Signs and symptoms (S&S) of wound infection may include: see Table 1: Clinical Signs and Symptoms (S&S) of Wound Infection) o new or increasing pain o delayed healing o an increase wound size (length, width, depth) o an increase in necrotic tissue/slough in the wound bed o an increase in exudate and/or change in the characteristics of the exudate o odour after wound cleansing o periwound inflammation: erythema, induration with an increase in warmth/temperature (all greater than 2 cms) o an increase in necrotic tissue/slough in the wound bed. • Inflammation is a normal body response to an injury. It occurs in days 1 to 4 of the wound healing trajectory and can be identified by four key signs: pain and peri-wound (less than 2cm) erythema, induration, warmth. In the event of a wound infection, there is a heightened inflammatory response involving immune cells, clotting proteins and signalling molecules which shows as increased peri-wound erythema/induration/warmth (greater than 2cm). This heightened response subsides with treatment of the infection. • A prolonged/chronic inflammatory response can occur when the treatment for heavy colonization or local infection is not effective in a timely manner. This prolonged response interferes with the normal wound healing trajectory and the increased cellular death related to the inflammatory response can lead to an increased risk of further wound infection. • A muted inflammatory response can occur in clients with certain clinical conditions such as diabetes, peripheral vascular disease, immunocompromised conditions, where the body can not generate normal response or the blood flow to the area is compromised. • Wounds infections are classified across a continuum: o contaminated, o colonized, o local infection, o spreading infection, and o systemic infection (sepsis).

	Local and spreading infections may transition to systemic infection and lead to death. They may display signs and symptoms similar to other medical conditions. A comprehensive wound assessment is needed to differentiate whether the wound is the source of the infection or another condition//issue is responsible. • Gram positive and negative bacteria (anaerobic and aerobic) commonly found in wound include: *Staphylococcus aureus*, *Enterococcus* spp., beta-hemolytic streptococci, and the Enterobacteriaciae (e.g., *E. coli*, *Enterobacter* spp., *Klebsiella* spp.), *Pseudomonas aeruginosa* and anaerobes (e.g., *Peptostreptococcus*, *Bacteroides species*) (see Appendix A: Examples of Microorganisms Commonly Found in Wounds). • Toxin-producing infections (e.g., *Clostridia* and some strains of *Group A Streptococci* and *Staphylococcus aureus*) requires an **urgent** consult to the Physician/Surgeon. • Thorough wound cleansing/irrigation, and when present, appropriate debridement methods to remove eschar and necrotic tissue/slough, are required to prevent chronic inflammation, reduce bacterial burden/biofilm load and the risk of infection. • Antibiotic treatment of wound infections should be guided by clinical assessment and C&S swab or tissue biopsy or needle aspiration result. Growth of more than 10^5 organisms per gram of tissue is usually considered positive for a wound infection. • Biofilm is present in 60-90% of chronic wounds and in 6% of acute wounds; it contributes to chronic inflammation and delays wound healing. As biofilms cannot be seen and standard culture methods do not capture the true level of biofilm present, determination is based on clinical assessment. Biofilm is managed the wound cleansing followed by topical antimicrobial dressing. • For local infections, a topical treatment using antiseptics or antimicrobial dressings is recommended. **Topical antibiotics are not recommended as they can increase the risk for an allergic response and the emergence of resistant microbes**.[21,44] • For spreading or systemic infections, a combination of topical antiseptics or antimicrobial dressings and systemic antibiotics (oral or intravenous) is recommended.
Bookmarks	Assessment • Table 1: Sign & Symptoms of Infection Determination of Treatment Interventions • Client Care Management • Wound Care Management ○ Strategies to Prevent Wound Infection ○ Strategies to Treat Local Infection, Spreading and/or Systemic Infection Definitions References/Bibliography Document Creation/Review Appendix A: Examples of Microorganisms Commonly Found in Wounds
Related Documents www.clwk.ca	Guideline Summary: Wound Infection Guideline: Wound Management for Adults & Children Procedure: Swab for Culture & Susceptibility (C&S) in a Suspected Wound Infection Procedure: Wound Cleansing Clinical Resource Table: Antimicrobials & Antiseptics Clinical Resource Table: Topical Antibiotics & Antifungal Guideline: Dressing Selection (under development) Guide: Dressing Selection (under development)

Assessment and Determination of Treatment Interventions

Assessment

1. Assess for Client Concerns
    a. Client/family level of understanding about risk factors for wound infection, the impact of infection on wound healing and the treatment of local infection, spreading and systemic wound infection.
    b. Impact of a wound infection on a client's quality of life and body image.
    c. Social and financial concerns and availability of support systems to address concerns arising for the wound infection.
    d. Client/family preferences for treatment of the wound infection, risk factors and the goals of care.
    e. Acknowledge culture and traditions.
    f. Client/family ability and motivation to participate in the treatment plan for wound infection.

2. Assess for Risk Factors for Wound Infection
    a. Chronic medical conditions, venous insufficiency, peripheral arterial disease (PAD), stroke, cardiac disease, and renal failure. As well, client that have a compromised immune system e.g., diabetes mellitus (DM), cancer and cancer-related treatments, autoimmune diseases, anemias, and rheumatoid arthritis.
    b. Advanced age.
    c. Impaired oxygenation status of skin and underlying tissue, e.g., chronic obstructive pulmonary disease, respiratory disease, heart failure, and anemia.
    d. Lifestyle factors such as cigarette and substance use and the motivation to quit.
    e. Poor personal hygiene (urine and/or fecal incontinence)
    f. Environmental hygiene (unsanitary shelter, water, waste disposal, or food sources).
    g. Medications that compromise the immune system e.g., antineoplastics, systemic corticosteroids; and drugs that support blood coagulation and flow anticoagulants and vasopressors.
    h. Elevated blood glucose (glycosylated haemoglobin - A1C) for clients living with diabetes.
    i. Impaired nutritional status:
        i. Low body weight, obesity, poor glycemic control, cachexia, hypovolemia/dehydration and prolonged nothing by mouth (NPO).
        ii. Adequacy of nutritional intake including percentage (%) of intake at meals, fibre intake, protein/calorie intake and fluid intake.
        iii. Possible causes of poor intake, e.g., difficulty swallowing, poor dentition, poor positioning for eating, inability to feed self, gastrointestinal symptoms, and pain.
        iv. Assess renal function if increased protein is indicated for the client.
    j. Presence of methicillin-resistant staphylococcus aureus (MRSA), vancomycin-resistant enterococci (VRE) colonization, extended spectrum beta-lactamase (ESBL), or other antibiotic resistant organisms (AROs), if known.
    k. Assess for other sites of infection, e.g., urinary tract infections, respiratory infections.

3. Assess for Pain Associated with Wound Infection
    a. New or recent changes in the character or severity of wound pain; type, location, quality of pain.
    b. Rate pain using client's self-report and/or observation of non-verbal cues.
    c. Impact of pain on activity/mobility, sleep and mood and rate overall quality of life rated by the client e.g., rate 1-10: 1 is poor quality of life, and 10 is healthy.
    d. Autonomic dysreflexia and/or increased spasticity in clients living with a spinal cord injury.

4. Assess the Wound for Infection
    - Presence of undermining, sinuses/tunnels, and if the wound probes to bone.
    - Presence of slough and/or eschar, presence of a foreign body.
    - The characteristic and amount of wound exudate/drainage.
    - Presence of odour, after wound cleansing.
    - Presence of periwound inflammation.
    - Presence of satellite wounds on the periwound skin.

Table 1: Clinical Signs and Symptoms (S&S) of a Wound Infection[2,13,32,38,44,47]

Clinical Signs and Symptoms (S&S) of a Wound Infection **Two (2) or more of the S&S below are sufficient for a clinical diagnosis of potential or actual wound infection.** **One (1) or more of the S&S below is sufficient for a client with DM, PAD or who is immunocompromised.**		
Contamination Microorganisms are transient, wound closes	• There are no signs of infection (erythema, pain, or excess wound exudate). • The wound progresses to closure in a timely manner.	Vigilance Required  Increasing Clinical Concern(s) Intervention(s) Required 

Colonization
Microorganisms present without usually impeding wound healing
	• There are no signs of infection (erythema, pain, or excess wound exudate).
	• The wound progresses to closure with minimal delay:
	  • If microbial colonization increases, there may be subtle delays in the wound healing progression, and/or
	  • Biofilm may develop, and interfere with the wound healing progression by contributing to chronic inflammation and may lead to a localized infection.	

Local Infection Microorganisms invade leading to healing impairment. Subtle S&S of infection may evolve into more classic S&S of infection.	• Increase and/or new onset of wound pain or increasing pain. • Periwound erythema, induration, warmth less than 2 cm. • Delayed healing and/or wound enlargement: less than 10% change in wound measurements after 1 week of care or less than 30% healing in 3 weeks. • Friable granulation / hypergranulation / bright red granulation tissue in the wound bed. • Epithelial bridging and pocketing in granulation tissue. • Increase in exudate and/or change in the exudate characteristic e.g., purulent. • Onset of, or increased, malodour after wound cleansing.	
Spreading Infection Microorganisms invade with classic S&S of wound infection	• Increased wound size with the presence of satellite, or new satellite wounds. • Periwound skin warmth extending 2 cm or greater and/or 2-3°C change in temperature with an infrared thermometer. • Periwound erythema and induration extending 2 cm or greater. • Mild to moderate periwound swelling/edema. Soft tissue crepitus around the wound may be present. • Increasing malodour after wound cleansing. • Changes or increased blood glucose • Lymphangitis (inflammation of the lymphatic system) or general malaise/lethargy.	
Systemic Infection Microorganisms invade with classic S&S of systemic infection	• Increasing general malaise/lethargy. • Fever, rigor and/or chills. • Change in behaviour or cognition e.g., acute delirium. • Increased in blood glucose levels e.g., clients with diabetes mellitus. • Autonomic Dysreflexia in clients with T6 spinal cord injuries or above. • Rapid, elevated heart rate and respirations. • Elevated white blood cell (WBC) count. • Severe sepsis leading to septic shock leading to multi-organ failure and/or death.	

Wound Infection Continuum [2,21,44,47]

Contamination - Wound contains low levels of non-proliferating microbes that typically do not impede wound healing.[2,47]

Colonization - Wound contains "microbial organisms that undergo limited proliferation without evoking a host reaction"[47]

Local infection - Occurs when microorganisms invade the wound tissue and evoke a host response. "Local infection is contained in one location, system, or structure".[47] Subtle S&S of infection may evolve into more classic S&S of infection.[2,25,47]

Spreading infection - Occurs when the microorganisms invade the wound leading to classic S&S of infection. Microorganisms proliferate and spread beyond the wound border, this may involve deep tissue, muscle, fascia, organs or body cavities.[47]

Systemic infection - Occurs when the microorganisms invade the body and spread via the vascular and lymphatic system. Systemic inflammation, sepsis, organ dysfunction and death may result.[47]

Assessment Considerations

a. If there are 2 or more clinical signs or symptoms of l**ocal infection** and/or **spreading infection** consult with the Physician/NP and intervention is required.
b. If there are 2 or more clinical signs or symptoms of **systemic infection** present, consult with the Physician/NP and intervention is required.
c. Notify the Physician/NP if the wound probes to bone, or if exposed bone is visible.
d. Biofilms are present in 60%-90% of chronic wounds and 6% of acute wounds, and can delay wound healing and contribute to chronic inflammation.[2,25] Standard culture methods or clinical assessment alone do not identify biofilms.
e. Some wounds may be in a state of chronic inflammation as evidenced by the wound condition e.g., presence of erythema, induration, warmth and pain. Determine if there is a change in these indicators, e.g., increased erythema and/or pain, which may be signs of infection.
f. For clients who are immunocompromised
    i. 1 or more signs and symptoms of infection, (local or systemic) especially if there is new or increasing pain, is sufficient to warrant consultation with the Physician/NP and doing a C&S swab.
g. Diabetic Wounds
    i. For clients with diabetes mellitus, 1 or more signs and symptoms of infection, (local or systemic) especially if there is new or increasing pain, is sufficient to warrant consultation with the Physician/NP and doing a C&S swab.
    ii. Diabetes mellitus may mute visible evidence of local infection, due to compromised arterial blood flow, blunting of the inflammatory process, and diminished sensation.
    iii. Uncontrolled blood glucose levels may indicate an infection (Guideline: Diabetic Ulcer)
    iv. **Areas of wet gangrene and spreading or systemic infection in diabetic foot ulcer, especially if the wound probes to bone, are potentially limb or life threatening and require immediate Physician attention.**
h. Arterial Wounds
    i. For clients with peripheral arterial insufficiency, 1 or more sign and symptom of infection, especially if there is new or increasing pain, is sufficient to warrant consultation with the Physician/NP and doing a C&S swab.
    ii. Clients with arterial wounds are at greater risk to develop a wound infection and visible evidence of a local infection may be muted or non-existent due to compromised arterial blood flow and blunting of the inflammatory process (Guideline: Assessment and Treatment of Lower Limb Ulcers)).
    iii. Dry, stable eschar arterial wounds may become moist and boggy at the edges, or periwound redness may develop, when the area/wound becomes infected.
    iv. **Areas of wet gangrene and spreading or systemic infection in extremity arterial wounds, especially if the wound probes to bone, are potentially limb or life threatening and require immediate medical attention.**
i. Venous Wounds
    i. Infected venous wounds may be characterized by newly formed ulcers, satellite wounds, or wound bed extension within the inflamed margins of pre-existing ulcers.
    ii. Venous wounds may exhibit periwound inflammation and warmth caused by venous dermatitis, allergic contact dermatitis or irritant contact dermatitis. Chronic inflammation may present as erythema, scaling, erosions, and/or excoriations (Guideline: Assessment and Treatment of Lower Limb Ulcers).
j. Pressure Injuries
    i. Infection most often occurs in Stage 3, Stage 4, Unstageable (Stage X) pressure injuries, and in Deep Tissue Pressure Injuries (DTPI).
    ii. For a pressure injury which probes to bone, consider osteomyelitis.
k. Surgical Wounds healing by Secondary Intention
    i. Monitor for wound infection.

5. Investigations, where available:
    a. Recent hemoglobin A1C, blood glucose and toe pressures (if available) if the client has diabetes mellitus.
    b. Radiology studies to rule out osteomyelitis, if the wound probes to bone or if exposed bone is visible.

Determine Treatment Interventions

1. Infection strategies for prevention and intervention are determined and initiated based upon:
    a. The client's overall assessment data.
    b. The presence/severity of wound infection - local infection, spreading infection, systemic infection.
    c. The wound healability (healable, maintenance, or non-healing).
    d. The client/family willingness to participate in the care plan.

Interventions

Develop a plan of care in collaboration with the client/family and health care team that incorporates client care, treatment of risk factors, treatment goals, wound management, intended and unintended outcomes, client education and discharge plans.

Client Care Management

1. Address Client Concerns
    a. The care plan should address client/family concerns for the treatment of the infected wound.
    b. If receiving palliative care/end of life services, incorporate client/family wishes in the plan of care.
    c. Consult with Case Management to request additional home support(s) as needed.
    d. Consult with Social Work, Facility Liaison, Aboriginal Health Representative, or Clinical Lead if there are psychosocial or financial concerns.
    e. Refer the client to the appropriate professionals to support improved health and wound healing, e.g., improved diet, access to food, medication management, and exercise plans.

2. Manage Risk Factors for Wound Infection
    a. Encourage the client to monitor any pre-existing illnesses or treatments that compromise the immune system or interfere with healing. Contact the Physician/NP if conditions deteriorate.
    b. Support client to stop smoking and refer to a smoking cessation program with client consent.
    c. Refer for harm reduction/substance use management if the client consents.
    d. Support the client to achieve optimal glycemic control; hemoglobin A1C should be done every 3 months or more frequently if blood glucose control is unstable Guideline: Assessment and Treatment of Diabetic Ulcers).
    e. Encourage clients to take their medications as prescribed. Consult Pharmacist if necessary.
    f. Treat other sites of infection e.g., urinary tract infection, respiratory infection.
    g. Provide optimum nutrition to promote client's healing:
        i. Maximize the nutritional status through adequate protein and calorie intake if compatible with goals of care.
        ii. Clients with chronic wounds should receive 35 kcal/kg of energy dense foods per day including 1.5 g of protein/kg.[33] Assess renal function if increased protein intake is indicated.
        iii. Encourage 1500-2000 ml of fluid daily or 30 ml or more per kg of body weight. Unless contraindicated e.g., renal, liver dysfunction or heart failure.
        iv. Offer fluids every 2 hours for adults with dehydration, fever, vomiting, profuse sweating, diarrhea or draining wounds, unless contraindicated (e.g., heart, liver, or renal failure).
        v. Consult with a Registered Dietitian, if available, if the infection is not resolving or reoccurs or the client has one or more of the following:
            - Nutritional risk factors such as weight loss, dehydration, obesity, poor intake, poor glycemic control, Total Parenteral Nutrition (TPN) or tube feed.

3. Manage/Provide Pain Relief
    a. **All new onset or worsening pain may be a sign of infection and requires immediate Physician/NP notification especially if the client has diabetes mellitus or arterial insufficiency.**
    b. If the client has known wound pain, and/or CSWD is required, organize prn analgesic administration prior to commencement of CSWD to allow sufficient time for the analgesic(s) to take effect.
    c. If pain before, during and/or after dressing changes is not well controlled with oral medications consult with the Physician/NP and Pharmacist. Discuss use of topical anaesthetic creams, gels or sprays. Consider use an analgesic cover dressing.
    d. Reassess wound pain at regular intervals and note any increase in severity or evidence of progressing infection.

Wound Care Management

1. Promote Environmental Strategies to Prevent Wound Infection:
    a. Adhere to health authority/agency hand hygiene protocols and Personal Protective Equipment (PPE) recommendations before, during and after dressing changes.
    b. Aseptic technique is used to limit the transfer of microorganisms from one person to another by minimizing the microbe count and preventing cross contamination. The technique used (see Definitions) can be either sterile, no-touch or clean and is chosen based upon the:
        i. client's clinical condition,
        ii. etiology of the wound
        iii. location of the wound
        iv. invasiveness of the procedure
        v. goal of care, and the
        vi. agency policy.
    c. Clients who require sterile or no-touch technique include, but are not limited to those who:
        i. are immunocompromised
        ii. are taking systemic corticosteroids or cancer medications
        iii. have a wound with exposed bone or tendon, or a wound(s) that probe to bone
        iv. have a burn(s),
        v. are at high risk for wound infection e.g. arterial and diabetic wounds and/or
        vi. have a wound needed Conservative Sharp Wound Debridement (CSWD).
    d. Cleanse the wound bed with at least 100mls of cleansing solution. Gently clean the wound with gauze with the goal of removing debris and slough from the wound bed. Removal of debris and slough reduces the risk that microbes will grow and helps prevent development of biofilms.
    e. Debride necrotic tissue using the most appropriate debridement method based upon the condition of the wound and the client setting (Guideline: Wound Management):
        i. Autolytic debridement with semi-occlusive dressings can be used if the wound infection is being treated, although this not a preferred method as this is a slower process.
        ii. Mechanical debridement can be used to physically remove debris from the wound using a mechanical debridement device e.g., monofilament pad and forceps.
        iii. Maggot debridement therapy can be used to debride biofilm and necrotic debris in wounds that are colonized or infected (Link Maggot Debridement DST).
        iv. CSWD may be used to disrupt or remove biofilms and necrotic debris. Serial CSWD may be necessary for wounds that have large amounts necrotic tissue or biofilm (Guideline: Conservative Sharp Wound Debridement)
        v. Surgical debridement may be required depending on client's clinical condition and wound complexity (e.g., necrotizing fasciitis).
        vi. Debridement of biofilm should be followed by the use of antimicrobial dressings, topical antimicrobial agents or antibiotics to help reduce reformation of biofilm (see Guideline: Dressing Selection (under development)).
        vii. A combination of debridement methods may also be necessary. Consult the Physician/NP and/or the NSWOC/Wound Clinician.

f. Take only the dressing supplies needed for the dressing change to the bedside or into the home; dressing supplies taken to the bedside or into the home cannot be returned to the dressing supply room/shelf.
g. For any acute care unit, residential facility or clinic area, client specific supplies must be labeled with the client's name and kept together in a labelled brown paper bag. This ensures reliable access to the supplies, aids in reducing cross-contamination, and protects dressings from light.
h. Supplies kept at the home must be kept secure from children or household pets.
i. Normal saline or sterile water containers are to be used by one client only and must be dated and discarded within 24 hours of being opened.
j. Wound care related powders, ointments, pastes, gels and cleansing solutions/sprays are for single client use only and must be labelled with the client's name and the date.
k. Discard unused product(s) as per the timeframe outlined on the Product Information Sheet (PI Sheet) or, if there are no instructions then discard when no longer indicated for use or the wound is closed/healed or product container empty. Discard if visibly contaminated.
l. When packing dead space (undermining, tunnels/sinus) it is important to use only one piece of packing whenever possible to avoid a piece of packing being left in the wound. Packing left in the wound can lead to infection and impaired wound healing. For any cavity, undermining, sinus tract or tunnel with a depth greater than 1cm (>1cm), count and document the number of packing pieces removed from the wound, and the number of packing pieces inserted into the wound.
m. Use the smallest size of wound contact layer that fits into, or covers, or can be cut to fit the wound bed.
n. Cover dressings should be sized to adhere to unbroken periwound skin and provide sufficient exudate absorption. Change cover dressings before leakage of exudate occurs. Leakage increases the risk that outside contaminants may enter the wound bed and damage the periwound skin.
o. Saving Dressing Pieces[1]:
    - When sterile technique is required for the dressing change use sterile dressing. Do not use dressings that been saved.
    - When no-touch technique is used for dressing changes, dressings must be either sterile or appropriately saved dressing pieces may be used.
    - If the dressing is larger than required to complete one dressing change, the unused piece(s) of dressing may be saved using the following process:
        i. In preparation for the dressing change, open the sterile package and place the dressing material onto the sterile dressing tray.
        ii. Use sterile forceps and sterile scissors to cut a piece of the dressing that fits into or covers the wound.
        iii. Use sterile forceps to place the remaining dressing piece into a new C&S container or a new re-sealable plastic storage bag (e.g., Ziploc bag). Each dressing needs its own container/storage bag.
        iv. Close/seal the container or bag correctly and label the container or bag with the client's name, the date and the name of the dressing. **Note**: Once a sterile C&S container seal is broken and open to the air, it is no longer considered sterile.
        v. If using a dressing piece that has been saved:
            - In preparation for the dressing change, use sterile forceps to remove a dressing piece from the container or bag and place the dressing material onto the sterile dressing tray.
            - Use sterile forceps and sterile scissors to cut a piece of the dressing that fits into or covers the wound.

[1] A literature review did not find any existing guidelines regarding how to appropriately save dressing pieces nor was literature found to refute this practice. An expert consensus process was used to develop this practice for British Columbia. These infection control strategies have been reviewed and approved by the British Columbia Provincial Infection Control Network Management Office.

- Use sterile forceps to place the remaining dressing piece back into the container or bag; label with the client's name, date and identify the name of the dressing.

vi. Saved dressing(s) pieces are only kept for 2 weeks; after that time discard the container or bag and any remaining dressing pieces.

vii. If saving another dressing piece, place it in a new C&S container or re-sealable plastic storage bag using the steps described above.

- When clean technique is used for dressing changes, dressings must be clean or must be appropriately saved dressing pieces. Any unused dressings may be saved using the same procedure as for no-touch aseptic technique dressing changes but with the use of clean instruments.

p. Notify the Physician/NP if:

i. Two (2) or more signs and symptoms of infection are present unless it is a diabetic wound then one or more symptoms of infection warrants notification to the Physician/NP.

ii. The C&S swab results are abnormal.

iii. The wound probes to bone, if this is a new finding.

iv. The wound does not show any signs of healing within 3 weeks of initiating appropriate treatment.

2. Promote Strategies to Treat Local, Spreading and/or Systemic Infection (reduce the microbial load)

For an Infected Healable Wound

a. Use sterile or no-touch aseptic technique with dressing changes.

b. Cleanse the wound bed: (Procedure: Wound Cleansing)

i. Thorough wound cleansing/irrigation is one of the most effective strategies for removing necrotic debris and/or biofilm from infected wounds.

ii. If using a topical antiseptic solution for cleansing wounds (see Clinical Resource Table: Antimicrobials/Antiseptics for Wound Care), monitor effectiveness of the slough/debris removal and discontinue antiseptic use once the infection is controlled and the wound bed is free of debris.

c. For the wound with 1 (muted), 2 or more signs of **local infection**:

i. Use a topical antimicrobial wound dressing wounds (see Clinical Resource Table: Antimicrobials/Antiseptics for Wound Care). Antimicrobial treatment needs to be reassessed after 2 weeks of use with discontinuation of the treatment once the infection has resolved, bioburden is controlled or the wound shows evidence of healing.

ii. Monitor frequently for improvement in the wound bed and assess the signs and symptoms of spreading infection.

iii. If the wound infection has not improved after 7-14 days collaborate with a NSWOC/ Wound Clinician, Physician/NP and interdisciplinary team. Consider other factors that could affect healing including nutritional status, the type of bacteria, ongoing pressure over the wound, poor blood supply or use of an inappropriate dressing and/or the need for a different antimicrobial.

d. For the wound with 1(muted) or 2/more signs of **spreading infection**:

i. Notify the Physician/NP for consideration of a C&S swab and systemic antibiotics (Procedure: C&S Swab in Suspected Wound Infection). Growth of more than 10^5 organisms per gram of tissue is usually considered positive for a wound infection.

ii. Antimicrobial wound dressings may be used in conjunction with antibiotics for spreading wound infection. Assess the signs and symptoms of spreading infection and monitor frequently for improvement in the wound bed. Contact the Physician/NP if improvement is not seen within 72 hours of starting systemic antibiotics.

iii. If wound infection does not show signs of improvement, consideration needs to be made of a different type of antimicrobial dressing and/or antibiotic.

e. For the client with 1 or more signs and symptoms of a **systemic infection:**
    i. Notify the Physician/NP for consideration of a C&S swab and systemic antibiotics. Growth of more than 10^5 organisms per gram of tissue is usually considered positive for a wound infection. Blood cultures are recommended if the client is febrile or hypotensive.
    ii. Antimicrobial wound dressings may be used in conjunction with antibiotics for systemic wound infection; monitor for signs of improvement and contact the Physician/NP if improvement is not seen within 3 days of starting systemic antibiotics.
    iii. If the client's infection does not show signs of improvement, consideration needs to be made of a different antibiotic.

f. For the client with diabetes and/or arterial insufficiency with 1 or more signs or symptoms of local, spreading, or systemic infection:
    i. Notify the Physician/NP for consideration of a C&S swab and systemic antibiotics.

For an Infected Not-Healing (Maintenance) Wound

a. Use sterile or no-touch aseptic technique with dressing changes.
b. For a previously dry, stable eschar (arterial wound) now showing signs of instability (eschar is softening despite application of Povidone Iodine to keep it dry) or S&S of infection (e.g. increase pain), do an urgent consult to the Physician/NP.
c. For all other maintenance wounds, where local, spreading or systemic infection is present, are to be treated to resolve the infection (see Interventions for Healable Wound c, d & e).

For an Infected Non-Healable Wound

a. Should be treated as per overall care goals (e.g., palliative care/end-of-life care directives).

3. Reassess the wound at every dressing change for signs of improvement or deterioration in the wound infection.

4. Notify the Physician/NP if the following occur:
    a. Acute onset of pain or increasing pain;
    b. Wound now probes to bone, indicating risk of osteomyelitis;
    c. Signs of local infection do not resolve within 7-14 days of antimicrobial dressing; and/or
    d. Signs of spreading or systemic infection do not resolve within 3 days of starting antibiotics.
    e. Clients who are immunocompromised, and/or those living with diabetes mellitus or PAD should be closely monitored as these types of wounds may rapidly deteriorate. Contact a Physician/NP at the first signs of wound deterioration.

Client Education

1. If the client has diabetes mellitus and has not previously participated in a Diabetic Education Program, discuss participation and refer with client consent.

2. Based on the client's knowledge and understanding about wound infection, discuss the following:
    a. Signs and symptoms of bacterial burden and local and systemic infection.
    b. Hand hygiene protocols and infection control prevention strategies.
    c. Personal hygiene, bathing, showering, if necessary.
    d. Additional signs of wound infection, such as uncontrolled blood sugars and/or increased pain or wound drainage.
    e. Healthcare professionals to contact if signs and symptoms of infection occur or increase.
    f. Strategies to prevent infection from reoccurring.
    g. Proper dressing technique, if client/family member will be changing dressing.

3. Provide educational material to support and reinforce teaching.

Discharge Planning

1. Discharge planning, including the date (approximate) when discharge is anticipated, should be initiated during the first client encounter and should support timely discharge and optimal client independence.
2. If the client's care is being transferred across sectors (acute care, community care or residential care), ensure that the receiving agency is provided with a current wound care plan that outlines the client care, wound management strategies, management of the wound infection, and any completed client education.

Client Clinical Outcomes

1. Intended - Healable Wounds
    a. The client's wound does not become infected and closes in a timely manner.
    b. There is early recognition of the risk of developing a wound infection.
    c. Interventions are implemented to prevent or limit wound infection.
    d. If a wound infection develops, appropriate strategies are implemented to assess, treat, and manage the wound infection.
2. Intended - Maintenance Wound (Slow-to-heal)
    a. The client's wound is maintained and is infection free.
3. Intended - Non-healable Wound
    a. The client's wound is monitored/managed to be infection free, as long as possible.
4. Unintended
    a. The client's wound becomes infected.
    b. There was not early recognition of the risk of developing a wound infection.
    c. Interventions were not implemented to prevent of limit wound infection.
    d. A wound infection occurred, and appropriate strategies were not implemented to assess, treat, and manage the wound infection.

Documentation

1. Document prevention strategies for clients at risk (e.g., immunocompromised, diabetes mellitus, older adults).
2. Report wound infection as per agency policy.
3. If wound infection suspected or present:
    - Notify Physician/NP.
    - Document the current treatment care plan as per health authority/agency policy.

Definitions

Acute Wound - A wound with an etiology that "occurs suddenly, either with or without intention, but then heals in a timely manner"[47]

Acute inflammatory response - A normal tissue reaction to injury that may include pain, swelling, itching, redness, and heat; caused when blood vessels dilate and leak fluid that contains leukocytes, plasma proteases and vasoactive amines such as histamine to stimulate healing.

Antimicrobials - Antimicrobial is a general term for drugs, chemicals and other substances that either kill or slow down microbe growth. Antimicrobial agents include antibiotics, antiseptics, antivirals agents, and antiparasitic drugs
Antiseptics - Antiseptics (topical) are antimicrobial agents that when applied to living tissue or skin, reduce the possibility of infection, sepsis and putrefaction. Antiseptics are distinguished from antibiotics by the latter's ability to be transported through the lymphatic system to destroy microbes within the body and from disinfectants which destroy micro- organisms found on non-living objects.[24] Antiseptics with low toxicity e.g., ~~10% Povidone~~ iodine, silver-based products, honey[46], and chlorhexidine or its derivative polyhexamtheylene biguanide (PHMB) may be used in wound care[37]. See Clinical Resource Table: Antimicrobials & Antiseptics for Wound Care.

Antibiotics - Antibiotics (topical and systemic) are drugs used to treat bacterial infections.[26]

Aseptic Technique - Technique used to limit the transfer of microorganisms from one person to another by minimizing the microbe count and preventing cross contamination; includes sterile, no-touch, and clean technique. The technique chosen is based on the client clinical condition, the type, wound location and depth, procedure invasiveness, goals of care and agency policy.

- Sterile Technique - the use of sterile gloves, a sterile field, sterile tray, sterile instruments, sterile solution and sterile dressings. Only sterile gloved hands or instruments are used for direct contact with the wound.
- No-Touch Technique - the use of clean gloves and a sterile field, sterile tray, sterile instruments, sterile solution and sterile dressings. Only sterile instruments are used for direct contact with the wound.
- Clean Technique - the use of clean gloves (single client use, non-sterile), a clean field, a clean or sterile dressing tray, clean instruments (single client use), clean solution (single client use) and clean dressings. Clean gloved hands or instruments are used for direct contact with the wound.

Autonomic Dysreflexia (AD) - A potentially dangerous syndrome affecting persons with a thoracic spinal cord injury at or above the T-6. AD is characterized by uncontrolled hypertension, bradycardia, severe headaches, and pallor below and flushing above the cord lesions, and convulsions. May result from bowel/bladder distension, pain, pressure injuries, and/or infection.

Biofilm - An invisible thin layer of microorganisms adhering to the surface of a structure, which may be organic or inorganic, together with the polymers that they secrete. Biofilms are present in 60% to 90% of chronic wounds and in 6% of acute wounds.[2] Biofilms are characterized by "significant tolerance to antibiotics and biocides"[47]. Biofilms lead to chronic inflammation interfering with healing and are not routinely detected in laboratory tests e.g., C&S swabs.[24]

Bioburden: This refers to the number of microbes present in a wound, when present they may delay or prevent wound healing.

Chronic wound - A wound that is slow to progress through the healing phases due to intrinsic and extrinsic factors. Chronic non-healing wounds could be suggestive of biofilm. A holistic evaluation is needed to correct underlying factors (e.g., ischemia).[47]

Chronic wound inflammation - A condition in non-healing wounds characterized by high levels of inflammatory cytokines matrix metalloproteinases (MMPs), reduced growth factor activity, and diminished quantities and responses of proliferative cells. Chronic periwound inflammation includes erythema, serous exudate, discomfort and warmth and can last for months to year.

Client - Recipient of care: community-client; residential care-resident; and in acute care-patient.

Client/Family - Two or more individuals who come together for mutual aid. Families are self-defined, and family is 'who the client says their family is'; this is individualized.

Conservative Sharp Wound Debridement (CSWD) - The removal of nonviable wound tissue using a scalpel, scissors or curette to create a clean wound bed; several CSWD's may be needed.

Cytotoxicity – Cytotoxicity is the potential damage or harm to a cell that could be caused by a substance.

Debridement -The removal of non-viable tissue to support the development of granulation tissue which is necessary for healing to occur. There are several different debridement methods.

Erythema - Redness around the wound, may be painful and edematous.

Eschar, dry stable - Firm, dry necrotic tissue with an absence of drainage, edema, erythema or fluctuance. It is black or brown in color and is attached to the wound edges and wound base.

Eschar, soft boggy - Soft necrotic tissue - black, brown, grey, or tan in color may be firmly or loosely attached to the wound edges and wound base; fluctuance and drainage may be present.

Fluctuance - Occurs when the wound has a 'wave-like' motion when it is palpated.

Gangrene - Several types of gangrene exist. Dry gangrene is characterized by dry, shriveled skin ranging from purplish-blue, black, and brown in colour and may occur in clients with peripheral arterial disease. Wet gangrene occurs when there is a bacterial infection in the affected tissue. Blistering, swelling and a 'wet-appearance' may occur (e.g., after frostbite or a severe burn).

Gram negative bacteria - This class of bacteria do not retain the crystal violet stain (Gram staining method), making positive identification possible; characteristic of bacteria that have a thin layer of peptidoglycan in their cell wall (see Appendix A).

Gram positive bacteria - This class of bacteria do retain the crystal violet stain (Gram staining method); characteristic of bacteria that have a thick layer of peptidoglycan their cell wall (see Appendix A).

Induration - Hardening of the periwound skin due to inflammation; may be secondary to infection.

Inflammatory response – Is the body's response after tissue damage, normal response occurs 1 – 4 days of the healing progess. Depending upon the client's underlaying clinical condition, the response may muted or can become prolonged.

Microbe: Microbes tiny living 'things' that are not visible to the naked eye. They are also called in microorganisms in the human body. Bacteria, viruses, and fungi are the most common. Less than 1% of bacteria are responsible for diseases (e.g., Tuberculosis). Viruses (e.g., AIDS, HIV) are protein-based molecules that require other cells

to reproduce. Fungi (e.g. yeasts, mold) can exist on the skin or in the body. An additional type of microbes called protozoa, are responsible for diseases such as malaria and toxoplasmosis.

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Pain Scales - Pain is a multidimensional assessment, including physical, emotional, and functional domains. Pain assessment tools have been designed for various age groups and conditions:

- CRIES Pain Scale – Used by the neonatal clinician to rate the client's pain by assessing crying, if the client requires oxygen greater than 95% (percent), noting increasing vital signs, facial expression, and sleeplessness.
- FLACC - Face, Legs, Arms, Cry, and Consolability is a behavioral pain scale used for the newborn to the age 3-year-old client (based on nursing judgment).
- Non-Communicative Patient's Pain Assessment Instrument (NOPPAIN) - Used to record the clinician's observations and rating of pain behaviors in the client with dementia.
- Numeric Rating Scale (NRS) - The client rates their pain from 0-10 (0=no pain;10=worst pain).
- Pain Assessment in the Advanced Dementia Scale (PAINAD) - Used to rate pain for the client living with advanced dementia; rates the client's pain after clinician observation of five minutes before scoring; the client may be observed at rest, during a pleasant activity, during care-giving, or after administration of pain medication.
- Visual Analog Scale (VAS) - Consists of a scale with face images depicting extremes of pain from no-pain to worst pain.
- Wong-Baker FACES Pain Rating Scale - A visual rating scale that asks the client to choose the face on the scale that best depicts the pain they are experiencing. The client rates their pain from 0 = does not hurt, to 10 = hurts as much as you can imagine.

Personal Protective Equipment (PPE) - Refers to protective gloves, gowns, and masks designed to protect the wearer from injury or infection.

Product Information Sheet (PISheet) - Developed by the Provincial Nursing and/or Interprofessional Skin & Wound Committee. PISheets are found on the British Columbia Patient Safety and Quality Council's Connecting Learners With Knowledge website.

Satellite wound - Small peripheral open areas that are around a larger central wound.

Slough - Soft, moist necrotic tissue that is brown, tan, yellow or green in colour. It may be thin or thick and the consistency may be fibrous, stringy or mucinous. It may be firmly or loosely attached to the wound edges and base.

Virulence: Virulence is the strength of the microbe/microorganism to damage or harm a host.

Soft Tissue Crepitus: soft tissue palpation around the wound

Wound infection continuum - Wounds can become contaminated or colonized by microbes which may lead to infections. Wound infections are classified on a continuum (see Table 1).

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Document Creation/Review

This guideline is based on the best information available at the time it was published and relies on evidence and avoids opinion-based statements where possible. It was developed by the Provincial Nursing Skin & Wound Committee and has undergone provincial stakeholder review.

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APPENDIX A: Examples of Microorganisms Commonly Found in Wounds

Updated June 2019 from CDC. (2019). http://cdc.org & Merck Manual. (2019). https://www.merckmanuals.com

Gram Stain	Micro-organisms	Description	Aerobic / Anaerobic
Gram positive	*Beta-Hemolytic Strep - Group A*	*Group A streptococcus* bacteria can cause a wide range of infections. Clients may also carry group A strep in the throat or on the skin and have no illness symptoms. Group A strep infections are relatively mild illnesses - "strep throat" or impetigo - a skin infection. Occasionally these bacteria can cause serious and even life-threatening diseases. • These bacteria spread through direct contact with mucus - nose or throat of people who are sick or through contact with infected wounds or skin sores. • Illnesses caused include *serious* illness such as pneumonia (lung infection), necrotizing fasciitis, or streptococcal toxic shock syndrome (STSS).	Aerobic
Gram positive	*Beta-Hemolytic Strep - Group B (Streptococcus agalactiae)*	Rates of serious group *B strep* infections are much higher among newborns than among any other age group, and serious group *B strep* infections occur in other age groups in both men and women. • Common problems caused by group *B strep* in adults include: bloodstream infections; pneumonia (infection in the lungs); skin and soft-tissue infections; sepsis and endocarditis, or bone/joint infections. Rarely in adults does *B strep* cause meningitis. • The source of infection for adults is unknown. Since group *B strep* is a common organism in the GI tract of men and women, this may be a source of some infection.	Anaerobic
Gram positive	*Clostridium*	*Clostridium* species inhabit soils and the intestinal tract of animals, including humans. *Clostridium* is a normal inhabitant of the healthy lower reproductive tract of women. It is spore forming, rod shaped - has multiple strains but *Clostridium Perfringens* is the main pathogen associated in wet gangrene and is capable of producing many different toxins. • Symptoms of invasion include severe pain, edema, tissue necrosis or separation of the skin into paper-thin black/purple layers along with a strong pungent odour. If unchecked can progress to gas gangrene which can be limb and/or life threatening.	Anaerobic
Gram positive	*Coagulase negative staphylococci (CoNS)*	*CoNS* are regarded as a pathogenic but they are increasingly recognized as causing of clinically significant bloodstream infections. *CoNS* are part of the normal flora of human skin and mucous membranes. *CoNS* are the most common cause of bacteremia related to indwelling devices (e.g., catheters) and most of these infections are hospital-acquired. • Important infections include central nervous system shunt infections, native or prosthetic valve endocarditis, urinary tract infections and wound infections. • Risk factors for *CoNS* infection include the presence of foreign devices (such as intravascular catheters) and immune compromise. • Treatment of *CoNS* infections can be challenging given limitations of antimicrobial resistance and the frequent presence of foreign material.	Aerobic
Gram positive	*Corynebacterium*	Corynebacterium species occur commonly in soil, water and food products. The genus contains the species *Corynebacterium diphtheriae* and the *nondiphtherial corynebacteria*, collectively referred to as diphtheroids. *Nondiphtherial corynebacteria* are increasingly recognized as pathogenic, especially in immunocompromised hosts. • *Nondiphtheiroid Corynebacterium* species can be found in the mucosa and normal skin flora of humans. • Common infection with these organisms is bacteremia in association with infections involving devices e.g., heart valves, catheters, and neurologic shunts. They are also found in wounds.	Aerobic & can also survive in an anaerobic environment
Gram positive	*Peptostrepto-coccus*	*Peptostreptococcus* are found predominantly in the mouth, skin, gastrointestinal, vagina and urinary tracts, and compose a portion of the bacterial gut flora. Under immunosuppressed or traumatic conditions these organisms can become pathogenic, as well as septicemic, harming their host. *Peptostreptococcus:* • Can cause brain, liver, breast, lung abscesses, and soft tissue (wound) infections; • Are the 2nd most frequently recovered anaerobes and account for approximately one quarter of anaerobic isolates found. • Grows slowly which makes them increasingly resistant to antimicrobials.	Anaerobic Non-spore forming
Gram positive	*Staphylococcus Aureus – S. Aureus*	*Staphylococci* (staph): A common type of bacteria that live on the skin and mucous membranes (e.g., in the nasal cavity) of humans. S. aureus is the most important of these bacteria in human diseases. They are only able to invade via broken skin or mucous membranes; hence, intact skin is an excellent human defense. However, damage to the skin or other injury may allow the bacteria to overcome the body's natural protective mechanisms of the body, leading to infection (e.g., pneumonia). *S. aureus:* • Is capable of causing various infections of the skin and other organs. • Infections are common with frequent skin injury, particularly if the skin is dry. • Most commonly found in wounds, especially diabetic foot ulcers (DFU). They are generally very hardy organisms.	Aerobic

Gram Stain	Micro-organisms	Description	Aerobic / Anaerobic
Gram negative	*Bacteroides fragilis*	Bacteroides are 1% to 2% of the normal colonic bacterial microflora in humans. They are significant pathogens and commonly found in most anaerobic infection. Bacteroides maintain a generally beneficial relationship with the host when retained in the gut, but when they escape they can cause significant pathology, including bacteremia, soft tissue and wound infections. • The species *B. fragilis* is an opportunistic human pathogen causing infections of the peritoneal cavity, gastrointestinal surgery, and in wounds. • Bacteroides fragilis is resistant to a wide variety of antibiotics — *β-lactams*, aminoglycosides, and recently many species have acquired resistance to erythromycin and tetracycline.	Anaerobic
Gram negative	*E. Coli (Entero-bacteriacea)*	Usually occurs later in the course of wound deterioration and in deeper wounds. *E. Coli* lives in the digestive tracts of humans. While many *E. Coli* are normal gut flora, some strains are human pathogens, and are known as the most common cause of urinary tract infections, gastrointestinal disease (ranging from simple diarrhea to severe dysentery-like conditions with abdominal cramping and watery diarrhea with blood), as well as other infections such as wound infections. • Potential sources of exposure are contaminated food or water and person-to-person contact. People who have weakened immune systems are more likely to become ill from *E. Coli*.	Anaerobic
Gram negative	*Extended-Spectrum Beta-Lactamase (ESBL) producing bacteria*	ESBL is a gram-negative bacteria that produces an enzyme; beta-lactamase has the ability to breakdown commonly used antibiotics, such as cephalosproins and penicillins and make them ineffective for treatment. Clients colonized with the bacteria carry the ESBL producing bacteria that cause infection without any signs or symptoms. • Escherichia coli and Klebsiella peunomiae (see below) are the most common forms. • ESBL producing organisms are commonly isolated from urine, wound or skin, feces and have also been found in blood and the respiratory tract. • ESBLs are usually spread via direct and indirect contact with colonized/infected client and contaminated environmental surfaces. • ESBLs are most commonly spread via unwashed hands of health care providers.	
Gram negative	*Klebsiella (Entero-bacteriacea)*	*Klebsiella* species are routinely found in the human nose, mouth, and GI tract as normal flora; however, they can also behave as opportunistic human pathogens. • *Klebsiella* organisms can lead to a wide range of disease states, notably pneumonia, urinary tract infections, septicemia, meningitis, diarrhea, and soft tissue (wound) infections. Infections are more common in the very young, very old, and those with other underlying diseases, such as cancer. • *Klebsiella* usually occurs later in the course of wound deterioration and in deeper wounds. • The principal pathogenic reservoirs for transmission of *Klebsiella* are the GI tract and the hands of hospital personnel.	Anaerobic
Gram negative	*Proteus mirabilis*	*P. mirabilis* causes 90% of all Proteus infections in humans. It is widely distributed in soil, water and is commonly found in the intestinal tracts of humans. • *Proteus* is also found in multiple environmental habitats, including LTC facilities and hospitals. In hospital settings, it is not unusual for *Proteus mirabilis* to colonize both the skin and oral mucosa of both clients and hospital personnel. Infection primarily occurs from these reservoirs. • *Proteus vulgaris* and *Proteus penneri* are also easily isolated from clients in LTC facilities, hospitals and from clients with underlying diseases or compromised immune systems.	Anaerobic
Gram negative	*Pseudo-monas aeruginosa*	*Pseudomonas* infection is caused by strains of bacteria found widely in soil, water and on the skin. The most common type causing infections in humans is called *Pseudomonas aeruginosa*. • *Pseudomonas aeruginosa* is a common bacterium that usually occurs later in the course of wound deterioration. It is also commonly found in diabetic foot ulcers. Because it thrives on moist surfaces, this bacterium is also found on medical equipment, including catheters. • Serious *Pseudomonas* infections usually occur in clients in the hospital and/or with weakened immune systems. • *Pseudomonas* infections, like those caused by many other hospital bacteria, are becoming more difficult to treat because of increasing antibiotic resistance.	Aerobic
Gram negative	*Veillonella*	*Veillonella* is a normal bacterium in the intestines and respiratory tract. It is a small, coccus that is part of the normal flora of the mouth, GI tract, and vagina in humans. • When isolated from clinical specimens, *V. parvula* is often regarded as a contaminant or commensal, but it has been implicated as a pathogen in infections of the sinuses, lungs, heart, bone, and soft tissue.	Anaerobic