Prevention and Management of Surgical Site Infections and Open Surgical Wounds Clinical Practice Guidelines: Overview and Clinical Applications

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Disclosure and Rules
- Previous Advisory Board Member (permission from WRHA)
- Not involved with Logistics Contracts
- All photographs with “Audiovisual Media Release (consent) Form”: not for use by others
- Slides on “Wound Healing Physiology and Delayed Primary Closure” courtesy of Dr. Vanessa Peliquin

Scope of Practice/Limitations
- St. B: Surgical Centre/ACSS
- 300 Ostomy Surgeries (70% emergent)
- 300 wounds
- In-patients/ACF Follow-up
- Clinical Practice involves Gastrointestinal, Genitourinary, Plastics, Vascular, Gynecological, and Cardiac Surgery
- Limited Head and Neck, Orthopedics
- Not Pediatrics, Burns, Trauma, MVA
Adapted from:

Overview Surgical Site Infections (SSI)
- Overview of SSI Guidelines
- Assessment, Plan and Documentation through Pre-Op, Intra-Op and Post-Op
- Prevention and Treatment Strategies
- Risk Factors: Controllable and Uncontrollable
- Intra-professional Team Approach
- Engagement of Patient/Family/Care-givers
- Assessment
- Normal VS Abnormal Surgical Wound Healing
- Debridement

Overview SSI (continued)
- Types of wound closure
- Signs and symptoms of SSI
- Classifications of SSI's
- Acute Vs Chronic
- Treatment
- Dressings
- Advanced wound care treatment
- Quality Improvement/Surveillance
- Clinical Applications throughout
Story of Ideal Patient

- Pre-op psychological, physical, social, spiritual and emotional preparation
- Fit and purposeful weight loss
- Talked with others who had same surgery
- Family and social supports
- Informed and educated
- Discharged with in 10 days of radical surgery with no complications
- Doing very well upon follow-up

SSI Facts

- Third most common Healthcare Associated Infections
- 25% Hospital Acquired Infections
- ↑ in mortality, readmissions and length of stay
- ↑ financial burden on healthcare system
- 40-60% preventable
- 47-84% occur after discharge
- 50% Home Care visits
- ↑ Antibiotic Resistant Organisms (ARO)
- 5% patients undergoing surgical procedure develop SSI
- 3000 patients within WRHA with SSI per year
- 2/3 incisional
- 1000 organ space

Definition of SSI

- An infection occurring within 30 days of surgical procedure if an implant is not left in place or within one year if an implant is left in place and the infection is determined to be related to the procedure
Not all surgical wounds are infected

- Smoking
- Malnutrition
- Co-morbidities
- Tension on wound
- Recent Chemo/Radiation Therapy
- Steroids and other Immunosuppressant drugs

Recommendation #1

- Complete a holistic assessment to identify factors that may affect healing in the pre-op, intra-op and post-op phases
- Review medical, family and social history
- Create a care plan
- Implement prevention strategies
- Document
- Communicate to the patient and team
  - Level of Evidence = NICE level 2+ and RNAO level IV

Communication
Prevention Strategies

- Pre-operative
- Intra-operative
- Post-operative
- Controllable
- Uncontrollable

Pre-Operative Phase

Uncontrollable Risk Factors
- Advanced Age
- Altered Immune System
  - Radiation Therapy
  - Chemo Therapy
  - Steroid use
  - HIV/AIDS
- Previous experience with anesthetic, polypharmacy, co-morbidities, dental issues and a prolonged pre-operative stay

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Pre-Operative Phase

Controllable Risk Factors
- Anxiety, stress and fear
- Altered nutrition
- Suboptimal glucose control
- Low Hemoglobin/oxygenation
- Smoking
- Obstructive sleep apnea
- Decreased physical condition
- Alcoholism
- Hygiene: patient and staff
- Infection
- Antibiotic resistant organisms (ARO)

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**Anxiety, Stress and Fear**

- Mild to severe
- Fear pain, loss of control, death, anesthesia (what will I disclose?), disfigurement, sexual dysfunction, separation, change in roles, financial
- Affects sleep, eating, concentration, heightens other risk factors. Provide education, support and reassurance
- Relaxation techniques, medication may be required


**Altered Nutritional Status**

- Malnutrition prolongs healing
- Pre-op nutritional support if severe malnutrition for elective surgery
- Nutrition screening prior to or within 24-72 hours of admission
- Weight loss/gain in past 6 months
- Obesity (BMI >30)
- Underweight (BMI <18.5)
- **Consult Dietitian** if NPO or clear fluids >5 days, poor oral intake <50% for >3 days, persistent nausea/vomiting, cachectic/wasted appearance or other issues affecting intake or poor healing


**Suboptimal Glucose Control**

- Alters tissue perfusion and interferes with release of oxygen to tissues
- Interferes with phagocytosis of leukocytes
- Educate patient on importance of optimal glucose control pre-op
- Pre-op blood glucose level, Hgb A1C
- Dietitian Consult may be required

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Low Hemoglobin/Oxygenation

- Tissue repair impaired if Hematocrit below 33% and Hemoglobin below 100g/l
- Decreased oxygen delivery
- Oxygen affects fibroblasts, collagen formation and wound tensile strength
- Consider the risks/benefits of transfusion
- Consult Blood Conservation Services if required


Smoking

- ↓ oxygenation
- ↓ healing
- ↓ micro vascular circulation
- Causes platelet aggregation
- Impairs hemoglobin function
- Encourage to stop tobacco use at least one month pre-op


Obstructive Sleep Apnea

- Known or suspect
- Bring CPAP machine to hospital

Decreased Physical Activity

- Assess for decreased physical activity or condition
- Consult Physiotherapy for pre-op assessment and recommendation
- Encourage activity as tolerated to maintain or improve physical condition

Alcoholism

- Folic Acid, Thiamine, and Multivitamin supplements
- Consult Pharmacy as needed
- Care plan should indicate to monitor for symptoms of withdrawal

Hygiene

- Shower, bathe or bed bath the day before or day of surgery
- Shower is preferable to decrease transfer of organisms from highly colonized site (penis) to less colonized sites
- No shaving in vicinity within one week of surgery
- Clippers if necessary within 2 hours Pre-op outside of OR theatre

Infections

- Identify and treat any remote infections prior to elective surgery


Antibiotic Resistant Organisms (ARO)

- Identify any MRSA, VRE etc.
- Institute Routine Practices
- Refer to the Operative Directive: Admission Screening of patients for Antibiotic Resistant Organisms (MRSA & VRE), as well as the Specific Disease Protocol for the ARO in the WRHA Hospital Infection Prevention and Control Manual


Hand Hygiene

- Refer to WRHA Routine Practices for Reducing the Risk of Infection Transmission Policy
  - http://home.wrha.mb.ca/corp/policy/files/90.00_060.pdf

Intra-Operative Phase

- Uncontrollable
  - Site, duration and complexity of surgery
  - Wound Classification
  - Multiple surgeries
  - Emergent vs. elective
  - Implants vs. no implants
  - Use of blood products
  - Duration of surgery/prolonged ventilation (≥2 hours)


Surgical Wound Classifications

- Class I/Clean: 1 – 5 % infection rate (THA, Mitral Valve, Breast bx)
  - Uninfected operative wound without inflammation
  - Not respiratory, alimentary, genital, or uninfected urinary tract
  - Primarily closed or drained with closed drainage
  - Operative incisional wounds with non-penetrating (blunt) trauma


Surgical Wound Classifications

- Class II/Clean-Contaminated: 8 – 11 % infection rate (Tonsil, Hyst, non-perf’d appe)
  - Respiratory, alimentary, genital, or urinary tracts entered under controlled conditions and without unusual contamination
  - Biliary tract, appendix, vagina, and oropharynx provided no evidence of infection or major break in technique is encountered

Surgical Wound Classifications

- **Class III/Contaminated:** 15 – 20% infection rate (Stab to chest involving lung, open cardiac massage)
  - Open, fresh, accidental wounds
  - Operations with major breaks in sterile technique, or gross spillage from the gastrointestinal tract, and incisions in which acute, non-purulent inflammation


Surgical Wound Classifications

- **Class IV/Dirty-Infected:** 27 – 40% infection rate (Perf’d appe, perf’d diverticulitis, Compartment Syndrome)
  - Old traumatic wounds with retained devitalized tissue
  - Existing clinical infection or perforated viscera
  - Organisms causing post-op infection present in the operative field before surgery


Controllable Risk Factors

- Prophylactic antibiotics
- Safe surgery checklist
- Pre-operative skin preparation
- Normothermia
- Tissue perfusion/hypovolemia
- Staff Policies
- Additional factors

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**Prophylactic Antibiotics**
- Completely infused prior to surgery to maximize effect
- Repeated for surgeries lasting longer than the half-life of the antibiotic
- Thoracic, orthopedic and vascular: stopped within 24 hours after surgery ends (46 hours for cardiac
- Non-complex surgeries: no further antibiotics
- Refer to The Compendium of Pharmaceuticals and Specialties (CPS): The Canadian Drug Reference for Health Professionals for half-life, admin rates etc.

<table>
<thead>
<tr>
<th>Pre-operative prophylactic Antibiotic</th>
<th>Drug Class</th>
<th>Infusion to be complete within specified time frame before first incision and application of tourniquet (if applicable) – to maximize antibiotic efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefazolin</td>
<td>Cephalosporins</td>
<td>Within 60 minutes of incision</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>Lincosamides</td>
<td>Within 60 minutes of incision</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>Fluoroquinolones</td>
<td>Within 120 minutes of incision</td>
</tr>
</tbody>
</table>

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**Antimicrobial Prophylaxis**
- Calgary Foothills Medical Centre Cardiac Surgery Program
- 2-3% SSI rates
- Chlorhexidine gluconate based products pre-intra and post-op
- Deep sternal infection rate decreased to 0.8% \(p=0.0002\)
- Donor site infection rate to 0%

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**Safe Surgery Checklist**
- Perform/complete the Safe Surgery Checklist
- refer to WRHA Surgical Safety Checklist – Operating Room Policy
Pre-operative Skin Preparation

- Surgical skin prep using an approved alcohol-based chlorhexidine antiseptic solution
- Allow prepped skin to air dry for at least 3 minutes prior to application of surgical drapes
- Should not be washed off for at least 6 hours following surgery
- Refer to WRHA Best Practice Guidelines, Surgical Skin Preparation

Normothermia

- Involves keeping the patient’s core temperature between 36°C-38°C
- Anesthesia, anxiety, wet skin preps and skin exposure in cold operating rooms can contribute to hypothermia
- Methods to maintain normothermia:
  - Forced air blankets for surgeries > 30 minutes
  - Warmed intravenous fluids for surgeries > one hour
  - Warmed lavage liquids for colorectal surgery
  - Ambient operating room temp. of 20°C - 23°C
  - Hats and booties on patients during surgery
  - Pre-warming 30 minutes to 2 hours prior to major surgery

Tissue perfusion/hypovolemia

- Maintain adequate oxygenation and circulation
- O2 sat level range should be consistent with as high a pO2 as possible without risking O2 toxicity
- Reduced tissue oxygenation and circulation impairs immunity by reducing:
  - Oxidative killing by neutrophils
  - Deposition of collagen
  - Chemotaxis and phagocytosis of granulocytes
  - Motility of macrophages
  - Production of antibodies
  - Production of super oxide radicals
Additional factors

- Glucose control
- Pain management
- Presence of suture or foreign body
- Surgical technique
- Instrument processing
- Operating room ventilation


Staff Policies

- All surgical team members who enter the semi-restricted and restricted areas of the surgical suite shall wear appropriate surgical attire (specific non-sterile theatre clothing) and adhere to the health care facility’s dress code policy.


Staff Policies and Protocol

- Scrubs, footwear, hair, reusable hats
- Finger nails clean, short, natural
- No artificial nails, extenders/enhancers
- Jewelry removed
- Personal protective equipment
- Surgical hand antisepsis/scrub
- Powder-free gloves
- Proper use of surgical drains and/or urinary catheters
- Limiting OR traffic/conversations
- Room cleaning protocol

**Post-Operative Phase**
- Address risk factors previously identified
- Ensure normothermia
- Hand hygiene and routine practices
- Maintain glucose control
- Antibiotics as per protocol
- **Document and Communicate** any potential postoperative risks to the post-anesthetic care unit (PACU) and all postoperative care providers

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**Perfusion**
- Pain, fear, smoking, medication and cold are sympathetic nervous system activators and may induce profound vasoconstriction in subcutaneous and skin blood vessels supplying peripheral tissue
- Ideal wound interface temperature is 37°C
- Reduced temperatures may inhibit the activity of phagocytic cells and affect cell mitosis

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**Pain**
- Assess and manage *pain*
- Refer to WRHA Clinical Practice Guideline, Pain Assessment and Management; and WRHA Best Practice Guideline, Normal Wound Healing
Nutrition

- Nutrition screening: Within 24-72 hours of admission
- Timely nutritional support: Protein, calories, and fluids via oral, enteral, or parenteral
- Supplements: Multivitamins, Vitamin C 500 Mg, and Zinc
- Consider protein losses from wound drainage
- **Consult Dietitian:** NPO or clear fluids >5 days, poor oral intake <50% for >3 days, persistent nausea/vomiting, cachectic/wasted appearance, or other issues affecting intake or poor healing
- Canadian Nutrition Screening Study 2012

Post-operative Incision Care

- Aseptic technique for dressing changes
- Maintain surgical dressings for 24 - 48 hours post-operatively; keeping the wound clean and dry to prevent infection
- Cleanse with sterile saline 48 hours after surgery
- Appropriate dressing and wound care regime

Edema

- Prevent venous stasis and control edema
- Early mobility and range of motion of extremities
- Elevation of affected limbs and use of compression stockings and/or sequential compression devices (SCD) providing the patient has adequate vascular supply
Support the Wound

- Support garments or devices post-op if tension on the wounds from internal/external forces
  - Ex. Front closing bra for elective cardiac surgery (sternal incision) applied in the OR
- Support garments and binders: Use with caution to prevent additional complications
  - Ex. Abdominal binder to prevent/support a dehisced abdominal wound: Apply 4cm below the xiphoid process to ↓ resp. complications
  - Allow for 2.5cm of space between the binder and the skin
  - To be worn when the patient ambulates
- Support garments and preferences are surgeon specific

Staff Education

- Basic wound care education
- Assessment and problem solving skills
- Wound care products
- Wound healing process and complications
- Moist wound healing principals

Consult Advanced Wound Care Specialist

- Surgical wounds that are not healing in a normal, timely manner should be referred to an Advanced Wound Care Clinician

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Recommendation 2

- Include the patient, family and/or caregiver as members of the team when developing care plans
- Assess, plan, implement and evaluate physical, emotional, social and spiritual needs of the patient
- Build relationships
- Collaborative approach
- Enable and empower
- Encourage active participation and engagement
- Maintain a partnership
  - Level of Evidence – NICE level 4 and RNAO level IV


Recommendation 3

- Educate the patient, family and/or caregiver to optimize surgical wound healing
  - Level of Evidence – RNAO level IV

Educate Patients, Family are caregivers

- Clear, concise and consistent
- Prevention strategies
- Hand hygiene
- Signs and symptoms of infection
- Given antibiotics?
- Provide and review written information
- Clarify questions
- Plain language
- Interpreter/instructions in other languages
- Who to call, and the contact number
- Follow-up appointments

Recommendation 4:

- Assess the surgical wound and document findings using a standard approach.
- A comprehensive wound assessment approach provides baseline data and identifies subtle changes that may indicate early signs of infection and, in turn, support timely, appropriate interventions.
  - Level of Evidence = RNAO level IV

Wound Healing Physiology

**Inflammation**
- Activation of coagulation cascade and platelet aggregation → control bleeding
- Platelets break down to release cytokines and growth factors → attract neutrophils and monocytes → clean wound bed

**Proliferation**
- Angiogenesis → supply blood to wound
- Collagen synthesis → depositing matrix material under the suture line → “healing ridge”
- Epithelialization → epithelial cells migrate to resurface the wound

**Remodeling**
- Collagen maturation → reinforce the scar
- Continues for >1 year


Wound Healing Physiology

**Inflammation**
- Obesity
- Infection
- Diabetes
- Immunosuppression
- Stress and Pain
- Nutritional deficiencies
- Hypothermia

**Proliferation**
- SSI – d4 – 7

Surgical Wound Closures

- Primary
- Secondary
- Delayed Primary Closure

Primary Closure
- Incision is sutured closed during surgery

Secondary Closure
- Surgical wounds described as dirty-infected, dehisced or ruptured heal best by secondary intention
- The wound is left open and heals when granulation tissue fills the wound from base up
- Rate of contraction of about 0.5 cm per week

Secondary Closure

Wound debrided
Dressings to heal

Silver Nitrate for hypergranulation tissue

Delayed Primary Closure

- Developed WWII to ↓ infection rate in contaminated, traumatic war wounds
  - Debrided and left open with packing for several days then sutured close
  - ↓ Infectious morbidity from 23% → 2%
- Advantages:
  - 4 days after wound opened
  - Success 81-100%
  - ↓ Healing time by 5-8 weeks
  - ↑ Patient comfort
  - Costs
  - Better cosmesis
- Disadvantages:
  - Re-infection
  - Recurrent wound disruption (abscess, seroma, minor wound separation)
  - Need for antibiotics remains unclear


Delayed Primary Closure

Abdominal Compartment Syndrome:
Debrided with NPWT for open abdomen
Once infection resolved fascia closed with mesh
Regular NPWT

Skin Closure with Retention sutures
Left in for 6 weeks due to high risk of dehiscence or evisceration
Types of Wound Disruptions

- **Incisional separation**
  - Skin edges are no longer opposed

- **Incomplete dehiscence**
  - Aka superficial separation
  - Distruption of skin and subcutaneous tissue

- **Complete dehiscence**
  - Involves disruption of fascia and often peritoneum

- **Evisceration**
  - Protrusion of bowel through the wound

- Can have dehiscence with intact skin, but deeper layers dehisced
- Evisceration requires EMERGENT surgical repair


Wound Dehiscence

- Initial dressing for 48 hours
- Reinforced prn
- Routinely assess incision and surrounding area
- Ensure patient/family/caregiver teaching occurs prior to discharge
- Since many post-operative infections occur after discharge, careful and thorough assessment and follow-up in the community is essential


Post-op Wound Assessment

- Initial dressing for 48 hours
- Reinforced prn
- Routinely assess incision and surrounding area
- Ensure patient/family/caregiver teaching occurs prior to discharge
- Since many post-operative infections occur after discharge, careful and thorough assessment and follow-up in the community is essential
Wound Assessment

- Measurement: Length x width x depth
- Exudate: Color, amount, consistency and odor
- Base and sides: amount, quality and type of granulation, slough or necrotic tissue, wet or dry
- Undermining or tunneling: amount and direction
  - Use clock method
- Surrounding tissue: redness, induration, warmth or pain (increasing or decreasing)
  - Outline with marker if red
  - Communicate
- Wound edge: approximation, dehiscence, edema


Recognizing Surgical Wound Healing

<table>
<thead>
<tr>
<th>Days</th>
<th>New Wound</th>
<th>Healing</th>
<th>Proliferative Healing</th>
<th>Day 15 – years 1 – 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incision color</td>
<td>Red, edges approximated</td>
<td>Red, progressing to bright pink (all skin tones)</td>
<td>Bright pink (all skin tones)</td>
<td>Pale pink, progressing to white or silver in light-skinned patients; pale pink, progressing to darker than normal skin color or may blanch to white in dark-skinned patients</td>
</tr>
<tr>
<td>Surrounding tissue inflammation</td>
<td>None present</td>
<td>None present</td>
<td>None present</td>
<td>None present</td>
</tr>
<tr>
<td>Drainage type</td>
<td>Bloody, progressing to yellow/clear</td>
<td>None present</td>
<td>None present</td>
<td>Any type of drainage (pus) present</td>
</tr>
<tr>
<td>Drainage amount</td>
<td>Moderate to minimal</td>
<td>None present</td>
<td>None present</td>
<td>Any amount present</td>
</tr>
<tr>
<td>Closure materials</td>
<td>Present, may be sutures or staples</td>
<td>Beginning to remove external sutures/staples</td>
<td>Sutures/staples removed, steristrips or tape strips may be present</td>
<td>None present</td>
</tr>
<tr>
<td>New skin</td>
<td>Present by day 14 along entire incision</td>
<td>Present along entire incision</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td>Healing ridge</td>
<td>None present</td>
<td>Present by day 9 along entire incision</td>
<td>Present along entire incision</td>
<td>Present</td>
</tr>
</tbody>
</table>

Unwanted results for surgical wound healing

- Incision: Red, edges approximated but tension evident on incision line; red edges may not be well approximated; tension on incision line evident; may remain red, progressing to bright pink
- Surrounding tissue inflammation: No signs of inflammation present: no swelling, no redness or skin discoloration, no warmth and minimal pain at incision site; hematoma (bruise) formation
- Drainage type: Red tinged/yellow and pus; any type of drainage (pus) present
- Drainage amount: Moderate to minimal; any amount present
- Closure materials: No removal of any external sutures/staples; sutures/staples still present; for secondary intention healing, failure of wound contraction or edges not approximated
- New skin: Not present along entire incision
- Healing ridge: None present along entire incision

How is This Wound Healing?

- Incision
- Surrounding tissue
- Drainage type
- Drainage amount
- Closure materials
- New Skin
- Healing ridge

Recommendation 5:

- Determine the effectiveness of the interventions and reassess if healing is not occurring at the expected rate. Assess the wound edge and rate of healing to determine if the treatment approach is optimal.
  - Level of Evidence = RNAO level IV

Wound Assessment

- Incision
- Surrounding tissue
- Drainage type
- Drainage amount
- Closure materials
- New skin
- Healing ridge
Recommendation 6:
- Debride the surgical wound of necrotic tissue.
  - Level of Evidence = RNAO level Ib

Debridement
- Removal of necrotic and devitalized tissue
- Decreases bacterial burden
- Eliminates senescent cells in chronic wounds

"Necrotic tissue is a foreign object and potential source of infection"

Wound Cleansing
- Removes exudate and surface debris
- Reduces bacterial burden
- Sterile Normal Saline
- 30 cc syringe with an 18-20 gauge venous access device held 10 to 15 cm from wound bed = 8psi.
- Larger/deeper wounds: 60cc catheter-tip syringe and red rubber catheter
- High pressure irrigation (select OR cases)

Types of Debridement

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharp</td>
<td>Scalpel, scissors or curette to remove devitalized tissue</td>
</tr>
<tr>
<td>Autolytic</td>
<td>Promoting activities of phagocytes and endogenous enzymes through moist interactive dressings and dextranomer/cadexomer iodine beads/paste</td>
</tr>
<tr>
<td>Enzymatic</td>
<td>Exogenous enzymes (e.g. collagenase, streptokinase) breaks down denatured collagen</td>
</tr>
<tr>
<td>Biological</td>
<td>Proteases secreted by larvae of maggots selectively digest non-viable tissue</td>
</tr>
<tr>
<td>Mechanical</td>
<td>Physical forces to remove wound debris (e.g. wet-to-dry dressings and pulsatile lavage)</td>
</tr>
</tbody>
</table>


Canadian Cost comparison

[Graph showing cost comparison]


Would you Debride this wound?

Dehisced abdominal wound
Is fascia intact?
Gentle serial debridement by surgeon only
Troughing then QID 10cm continuous AMD oil gauze and 1 to TID/BID with drainage and as wound cleaned up
Leave large blue deep retention sutures alone
NPWT?
Nutritional support
Emotional/psychological support
Follow-up
Recommendation 7

- Rule out or treat a Surgical Site Infection
- Wounds following surgical procedure are classified as superficial incisional, deep incisional, or organ/space, depending upon the tissue or body part involved.
  - Level of Evidence = NICE level 4 and RNAO level IIa

Acute Surgical Site Infection

- SSIs rarely occur during the first 48 hours after surgery
- Fever first 48 hours usually noninfectious or unknown causes
- Most SSIs within 30 days of surgery or within one year if implant inserted


However...Early Post-Operative Wound Infection

- Surgical site infections usually present POD4-7
- If evidence of surgical site infection POD 1-3
  - Suspect necrotizing soft tissue infection
    - Group A streptococcus
    - Clostridial infections

Microbial Progression in Wounds

Contamination
- Entry of microorganisms into tissue

Colonization
- Establishment of an established microbial population

Critical Colonization
- Established microbial population, wound not progressing, microbial imbalance, no signs of infection

Infection
- Microbial control

Systemic antibiotics & topical antiseptic agents

Classifications of SSIs

CDC Classification of SSI
- Within 1-9 days of operation, within 30 days of implant insertion

- Incisional
  - Superficial
    - Involving only skin and subcutaneous tissue
  - Deep
    - Involving deep soft tissues

- Organ/space
  - Involving an area other than incision opened or manipulated

Necrotizing Fasciitis Post C/S
- Debride by Plastics
- IV antibiotics
- Aqueous 0.05% Chlorhexidine solution on continuous gauze roll QID for local infection
- Negative Pressure Wound Therapy once infection treated
- Split Thickness Skin Graft

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Infection

- Prolongs the inflammatory phase
- Delays collagen synthesis
- Prevents re-epithelialization

Infection Signs and Symptoms

- Redness, warmth, induration and pain
- Odorous discharge within 48 hours
- Serous or purulent exudate, erythema, ↑ skin temp around the wound
- Night sweats, fever, chills, ↑ pain, malaise, and ↑ WBC
- Friable granulation tissue, deterioration of wound
- May need antimicrobial therapy
- Open wound to drain and treat infection (MD or authorized Advanced Wound Care Clinician)
- Drain a deep tissue abscess (may have diarrhea)
- Exposed bone: suspect infection until ruled out

Is this wound infected?

- Note edema
- Monitor WBC, vital signs
- Abdominal Binder
- Monitor drainage or bruising
- Demarcation up to 6 weeks
- Nutritional support


Culturing Wounds

- When to swab
- How to swab
- Probes to bone (suspect osteomyelitis)
  - X-ray
  - ESR

CDC Antimicrobial Treatment

- Topical antimicrobials for local treatment
- Systemic antibiotics:
  - Presence of cellulitis
  - Severe or rapidly progressing infection
  - Systemic illness
  - Co-morbidities leading to immunosuppression (DM, neoplastic process)
  - Extremes of age
  - Lack of response to opening wound alone
  - Location where complete drainage is difficult/impossible
- Long term systemic antibiotics for osteomyelitis

Outdated Antiseptics

- Povidone iodine, hydrogen peroxide, acetic acid, sodium hypochloride (Eusol, Dakin’s) are:
  - Toxic to fibroblasts
  - Toxic to tissue and tissue defenses
  - Destroys keratinocytes: inhibits healing
  - Stops capillary blood flow
  - Never were intended for wounds! (Flemming, 1919)
New Generation Antimicrobials

Silver, Cadexamir Iodine or Chlorhexadine
Tulle gras, liquids, sheets, absorbent pads, ropes, gels, pastes and ointments
Slowly released into the wound
Reduces bacterial burden
Local infection or heavy colonization

Is this wound infected?
Readmitted with pain to midline abdominal wound following hernia repair and resiting of stoma
Serous collection in upper wound spontaneously drained
Seroma on lower wound needs to be drained
Not infected: normal WBC, no fever
Wick with continuous gauze strip to allow to drain
Discharge with daily dressing changes

Antibiotics < 48 Hours Post-Op
- SSI unlikely
- True soft-tissue emergencies are necrotizing clostridial or mixed anaerobic cellulitis, or streptococcal necrotizing fasciitis
- Urgent surgical consultation
- Administration IV antibiotics based on likely causative microorganisms
- Consult with a pharmacist for:
  - Penicillin G + clindamycin
  - Cefazolin + metronidazole
  - Vancomycin + metronidazole


Antibiotics > 48 Hours Post-Op

- Open wound and send C & S
- Ultrasound or imaging to rule out/drain abscess
- For surgeries above the waist (i.e. head, neck, trunk or upper extremities):
  - Cefazolin
  - Clindamycin
  - Vancomycin
- For surgeries involving the abdomen, perineum, genitourinary tract or lower extremities (increased likelihood of contamination with microbial flora originating from the gut):
  - Cefazolin + metronidazole (or clindamycin)
  - Clindamycin + ciprofloxacin

Is this wound Infected?

Ask the Patient:

- How is your pain?
  - Better, worse or same?
- How do you feel?
  - Better, worse or same?

Assess the patient:
- The eyes tell all
- C&S
- Systemic antibiotics

Chronic SSI (>30 days)

- Symptoms: pain, ↓ in function; fever may be absent, with normal vital signs
- Exudate: ↑ levels of matrix metalloproteases:
  - Slow or blocks cell proliferation
  - Degrade the wound matrix
  - Contribute to prolonged inflammation
- Signs: poor healing, unresolved dehiscence, new sinus or fistulas; persistent wound drainage; presence of a foreign body or devitalized tissue; poor vascularity, odor, or infected prosthetic implant
- Extent depends upon surgery done and systems involved
- Surgery to debride, close a fistula or ulcer space; or drain/remove a sinus tract
- Colonization: MRSA, Gram-negative bacteria or fungi; treat if symptomatic
- Rehabilitation usually needed

Recommendation 8

- Provide optimal local wound moisture balance to promote healing by choosing an appropriate dressing for the acute and chronic phases of surgical wound.
- Moist wound healing is one of the cornerstones of evidence-based wound care in both the acute and chronic settings.
  - Level of Evidence = NICE level 1+ and RNAO level IV.

Moist Wound Healing

- Increased angiogenesis
- Faster healing / less infection
- Autolysis
- Decreased pain / protect wound
- Quality healing / reduced scaring
- Cost effective / user friendly
- Decreased allergies / sensitivities

Dressing Categories

- Gauze
- Foams
- Calcium Alginates and Hydrofibers
- Hydrogels
- Hydrocolloids
- Transparent Films
- Composite Dressings
- Non-Adherent
- Antimicrobials

Refer to WRHA Wound Care Appendix B: Dressing Selection
http://www.wrha.mb.ca/professionals/eppt/ecsawc-11appendixb.pdf
**Dressings for Acute Surgical Wounds**

- High exudate from edema, third spacing and fluid resuscitation
- Exudate rich in white blood cells, protein, essential nutrients and growth factors that support the stimulation of fibroblasts and production of endothelial cells
- Dressing based on:
  - Type of closure (primary, delayed primary intention or secondary intention)
  - Amount of exudate
  - Care setting vs discharge planning
  - Cost effectiveness
  - Goals (heal, odor, pain or palliation)
  - Consider patient concerns, caregiver knowledge and time, setting, and available resources


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**Gauze in OR**

- If secondary closure:
  - Counted radiopaque sterile surgical sponges left in patient
  - Record the location, number and type on peri-operative record
  - Clear communication
  - Removed only in the OR
  - Recounted, documented and bagged
  - Sponge count must match and be accounted for
  - Intra-operative x-ray if discrepancy


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**Packing with Gauze is NOT an Olympic Sport!**

- Strip gauze: small, narrow or tunneling with less exudate
- 5cm or 10cm wide rolls for moderate to large exudate
- Use ONE continuous length
- Fill lightly and completely
- Too tight: Pain, drainage, and slow healing
- Fill wound to prevent premature skin closure
- Allows the wound to close from the inside out
- Caution: pain and dispersal of bacteria into the air when removed
- For epithelialization

Large Wound with Fistula

Acute: 51 x 28 x 15cm
Nutrition, prevent evisceration with abdomen, manage drainage, support, teamwork.

Chronic: 39 x 12 x 6cm
Nutrition, manage drainage, ongoing support, teamwork.

Minimize Tape to Skin

- Tie tapes
- Skin “preps”
- Elastic netting
- Tubular mesh
- Mesh pants
- Abdominal binder*
  *Caution: limits respiratory movement

Calcium Alginates

Haemostatic properties (donor sites, bleeding)
Absorbent: watch costs
Not painful to remove
Sheets and ropes

Heparin Induced Skin Necrosis
Negative Pressure Wound Therapy at lowest setting: watch for bleeding
STSG
Hydrofibers

Forms gel with wound drainage
Absorbent:
Wound base visible, so dressing is not left in wound
Not painful to remove
Cost effective is decreases frequency of dressing changes
Discharge planning
Cover dressing required


Foams

Heavily exudating wounds
Absorptive
Semi-permeable polyurethane
Thermal insulation
Available in adherent and non-adherent


Heavily Exudative Wounds: Troughing Vs Pouching

TROUGHING:
• Larger wounds or fistulas
• Custom made system to channel exudate into a pouch

POUCHING:
• Copious exudate, odor, protect skin
• > 25 mL discharge /24 hours
• QID dressings
• Wound location, comfort, mobility and staff resources

Consult your Enterostomal Therapy (ET) Nurse

Hydrogels

- Water or amorphous gels, impregnated gauze or sheet dressings
- Imparts moisture: only for dry wounds
- Cool, comfortable
- Protects granulating and epithelializing wounds
- Autolytic debridement
- Can be used on infected wounds


Clear Acrylic Absorbent

- Minimally exudative wounds
- Can be left on for up to 28 days
- Clear for visualization

Non-Adherent Dressings

- Non-adhesive silicone
- Polyurethane mesh
- Paraffin impregnated gauze
- Protects wound bed
- Requires cover dressing
- Use as interface dressing for NPWT
- Malignant wounds
- Frangible or painful wounds

Non-Adherent Dressings

Malignancy?:
• Pain
• Odor
• Support
• Radiation?


Final Words

➢ Wounds are dynamic
➢ Wound assessment guides decisions
➢ Reassess the patient and the wound
➢ Dressing choice is within the scope of nursing
➢ Technology changes
➢ Know your limits: refer to an Advanced Wound Clinician if no healing within 6 weeks or if the wound deteriorates

Recommendation 9:

➢ Consider the use of negative pressure wound therapy (NPWT) and biologically active dressings
➢ Level of Evidence = NPWT: RNAO level IV
Negative Pressure Wound Therapy (NPWT)
- Negative Pressure Therapy (sub atmospheric pressure)
- Promote wound healing
- Remove excess fluid
- ↑ Vascularity
- Contract wound edges
- ↓ Colonization
- Refer to the WRHA Use of Silver Dressings and Negative Pressure Wound Therapy Clinical Practice Guidelines available at http://www.wrha.mb.ca/professionals/cbp/files/NPT-Guidelines.pdf

Contraindications for Negative Pressure Therapy
- Necrotic tissue
- Not over exposed blood vessels and/or organs
- Untreated osteomyelitis
- Non-enteric or unexposed fistulas
- Malignancy
- Infection must be treated
- Caution: Active bleeding, hemostasis difficulties, on anticoagulants

Biologically Active Dressings
- Reconstruction or scar revisions
- Living human fibroblasts, extracellular matrix, collagen-containing preparations, hyaluronic acid and platelet–derived growth factor
- To stimulate healing or to produce skin substitute for use in acute and chronic wounds
- For acute and chronic difficult-to-treat wounds
- Advanced skill is required
- Not if infected, malignancy, sinus tracts or excessive exudate, or on patients known to have hypersensitivity to products
- Consider cultural issues

Recommendation 10:

- Recognize that surgical wound healing requires a **team approach**.
  - Level of Evidence = NICE level 4 and RNAO level IV

**Team Approach**

- Patient-centered care
- Culturally appropriate services
- Acknowledging challenges and barriers
- Teamwork with patients and families
- Interdisciplinary team communication is essential


Recommendation 11

- Implement a **surgical site surveillance program** that crosses clinical setting boundaries.
  - Level of Evidence = NICE level 4 and RNAO level IV

Surgical Site Surveillance Program

- SSI surveillance reduces SSI rates by 32 per cent
- SSI surveillance at least 30 days to a year, following surgery
- Involve Infection Control
- Identify SSIs in the community


http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/SSI.pdf

Where do we go from here?

- Prevention
- Implement standards

Dear God,
My prayer for this fiscal year is for a fat bank account & a thin body.
Please try not to mix them up like you did last year..

AMEN!

THANK YOU!!!!