



# WOUND INFECTION PREVENTION IN HUMANITARIAN RESPONSE

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Disaster Relief, Refugee Relief,  
and Humanitarian Emergencies

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# Webinar Objectives & Outline

## Learning Objectives:

- Wound Infection Prevention in Humanitarian Response
- Role of Irrigation in Infection Prevention
- “Treat the Whole Patient, Not just the Hole in the Patient”

## Webinar Outline:

- The **Problem** of Wound Infection
- Current **Guidelines** to Prevent Wound Infection
- **Irrigation** as a Key Component - Comparative Data
- Call to Action

# Acute Traumatic Wounds - Infection Risk Factors

- Wound Type
- Cause
- Location - Lower Extremity greater risk
- Size & Depth
- Tissue Borders and Depth of Tissue Layers Involved
- Contamination - microbial insult
- Foreign Body
- Time from injury to treatment
- Quality of Cleansing / Debridement / Irrigation
- Patient underlying Medical Conditions



Laceration



Open Fracture



Amputation

# Acute Traumatic Wounds - Additional Images



# Wound Infection - Environment Risk Factors

- Available Resources / Supplies
- Working Area Clean
- Hand Hygiene & Use of Gloves
- Cultural / Social Barriers
- Reuse of Single use items
- Patients – Engaged & Educated about Follow Up Care



# Environment Risk Factors – Additional Images

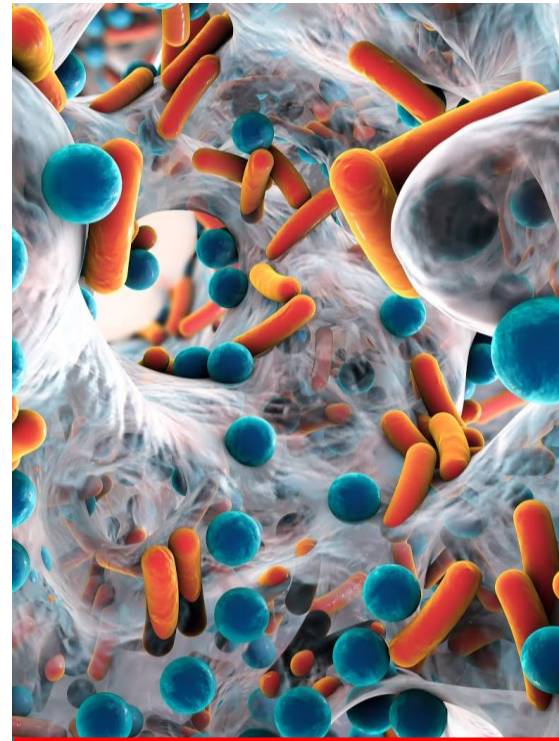


# Consequences of Wound Infection

The actions taken pre-hospital have significant impact in preventing infection later...

## Patient Impact:

- Poor Healing
- Infection
  - **Biofilm Formation**
  - Spread to deep tissues
  - Necrosis
  - Enters Bloodstream – Sepsis



# Wound Infection – Additional Images





# Consequences of Wound Infection

- **Decreased Quality of Life for Patient**

- Loss of function
  - Amputation
  - Disability
- **Morbidity** - Complication or undesirable outcome
- **Mortality** - Death

- **Family**

- Impact on Livelihood

- **Impact on Healthcare Teams, Outcomes, & Metrics**

- Increased occupied beds
- Financial Strain on Limited Resources



# Bacterial Wound Infection

## Sources of Contamination

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- Environment:
  - Soil/Debris
  - Contaminated water
  - Air quality (Particulate matter)
- Cross-Contamination
  - Skin
  - Body's Normal Flora
  - Contaminated equipment

## Common Bacteria

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- Staphylococcus Aureus
- Multi-Drug Resistant Organisms (e.g., MRSA)
- Pseudomonas Aeruginosa
- Enterobacteriaceae
- E Coli
- Klebsiella Pneumoniae
- Acinetobacter Baumannii

# Key Guidelines & Protocols - Acute Wounds

## International Federation of Red Cross and Red Crescent Societies (IFRC)

- International First Aid Resuscitation & Education Guidelines 2020

## World Health Organization (WHO)

- Management of Limb Injuries During Disasters and Conflicts
- Global Guidelines for the Prevention of Surgical Site Infection

## Médecins Sans Frontières (MSF, Doctors Without Borders)

- Medical Protocol - Wound Care Protocol

# Key Points from Guidelines, Wound Infection Prevention

## Hand Hygiene to Prevent Contamination

- Cleanse Hands with Liquid Soap or Alcohol Based Cleaner Before and After Wound Care - during if become Soiled
- Cleanse Hands **AFTER** Removal of Gloves

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## Treatment Area Cleanliness

- Clean **ALL** Surfaces prior to care with a disinfectant
  - Do Not let people walk in and out of area during wound care
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# Key Points from Guidelines, Continued

## Maintain Asepsis - Do Not Cross Contaminate

- Maintain a **Clean Dry** Area for Wound Care
- Wear Non-Sterile Gloves and Change if become dirty or contaminated (use Sterile Gloves for Surgical Care)
- Use Disposable Apron or Gown if available
- **Do Not Touch Supplies** with Dirty Hands or Gloves
- **Do Not use expired Supplies** - Packages Clean (not open or soiled)
- **Do Not Reuse** Single Use Items
- Properly Clean / Sterilize Reuse Items

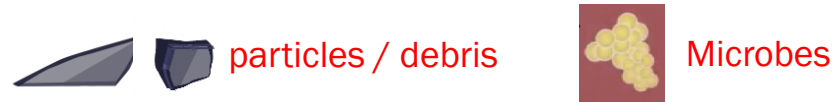
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## Wash / Cleanse Surrounding Skin

- Use Liquid Soap on Intact Skin
- Use Povidone Iodine (PVP-I) Soap or Solution **7.5%**; Rinse with Sterile Water or **0.9% NaCl** on skin surrounding wound

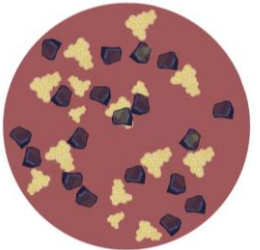
# Key Points from Guidelines, Continued

"Contaminated wound"



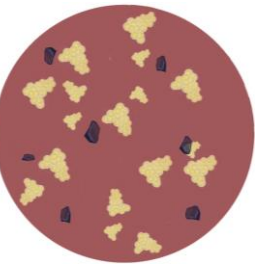
## Initial Irrigation Debridement

- Remove large visible particles / debris to clean wound



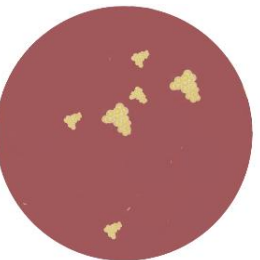
## Mechanically Debride

- Use Gauze to remove visible contaminants
- Surgical debridement to remove all dead, contaminated, and infected tissue.



## Final Irrigation of the Wound

- Final Cleanse to Remove Visible Debris & Microbes**



# Key Points from Guidelines, Continued

## Wound Dressing as Appropriate to Wound Type

- Dress the Wound if:
    - No Excessive Swelling
    - Bleeding Controlled - No active bleeding seen
    - Wound Bed Clean of Visible Debris
  - Non-Woven Compress / Covering to prevent sticking to the wound
  - Wound Dressing dependent upon wound type
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# Key Points from Guidelines, About Irrigation

## International Federation of Red Cross and Red Crescent Societies (IFRC)

- International First Aid Resuscitation & Education Guidelines 2020  
*“Clean the wound and cover it to increase healing and reduce risk of infection.”*



## World Health Organization (WHO)

- Management of Limb Injuries During Disasters and Conflicts  
*“Volume is important... Irrigate with a Volume between 3 & 12 Litres of Fluid”*  
*“Topical Antibiotics are not effective and leads to more antibiotic resistance”*  
*“Systemic Antibiotics cannot replace cleaning and surgical debridement of wounds”*



## Médecins Sans Frontières (MSF, Doctors Without Borders)

- Wound Care Protocol: *“The decision to apply an antiseptic or not or to start a systemic antibiotic or not will be taken based on wound classification...by the medical team”*





# Purpose of Effective Wound Irrigation

## What is Wound Irrigation?

- Steady flow of solution across an open wound surface

## Why Irrigate the Wound

- Remove Debris
- Reduce Overall Microbial Load
- Wound Hydration

# Goal of Effective Wound Irrigation

## Goal

- Reduce Infection
- Promote Healing
  - Prevent Local & Systemic Complications
- Help Restore Patient's Quality of Life
- Decrease Morbidity and Mortality Rates
- Reduce Health Care Costs and Resource Strain

# Wound Irrigation Considerations

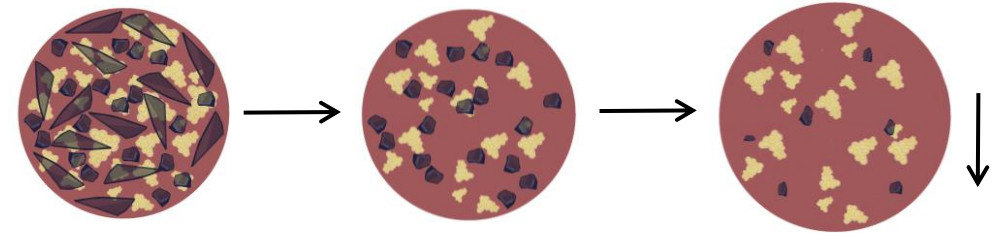
- **Sterility of Solution**
- **Volume of Fluid - *“The Solution to Pollution is Dilution”***
- **Pressure of Fluid - Pressure applied through various means - compressible bottles, bulb syringes, syringes and “spiked” bags**
  - Too Little - Fails to adequately remove enough contaminants and debris, thus inhibits wound healing. **Do not just pour.**
  - Too Much - Forces bacteria into wound bed & damages tissue. **Do not use high pressure pulse lavage.**
  - **Moderate pressure should be employed for acute wound irrigation.**

# Wound Irrigation Considerations

- **Antiseptic Solutions, Considerations**
  - Concentration
  - Toxicity
  - Pre-mixed
  - Mix your Own
    - Risk of contamination
  - Dwell Time (time to kill)

Antiseptic Irrigation **does not** replace large volume saline irrigation.  
Antiseptic irrigation is typically used as a final rinse to lower microbial load.

# Wound Irrigation Choices



Contaminated Wound    Initial Irrigation    Mechanical Debridement

## Solution

## Considerations

### Water

Use if Saline Not Available. Sterilize by boiling.  
Unknown contaminants.

### Saline

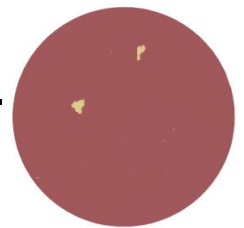
No Antimicrobial properties. Use Large Volume of Saline Under Pressure for initial removal of particulate, debris, and some bacteria.

**Antiseptic Irrigation:**  
Povidone Iodine or  
Chlorhexidine Gluconate

Antiseptics kill microbes on contact. Use antiseptic solutions to further lower microbial load after debridement & saline irrigation.  
**Especially important in acute traumatic wounds in humanitarian emergencies (high risk of infection).**



Volume Irrigation



Antiseptic Irrigation

# Safety of Antiseptic Wound Irrigation Solutions

*Deep Traumatic Wounds often expose subcutaneous, muscle, and bone tissue*

## Povidone Iodine (“PVP-I”)

- Broadly available as **4%, 7.5%, 10% topical solution**, used extensively for minor cuts and scrapes and for surrounding skin antiseptics.
- **Not Safe for subcutaneous use.**
- **DO NOT USE** on open wounds.
- Toxic to wound healing
- **NON-STERILE**, not packaged to deliver under pressure
- Frequently diluted which may cause contamination and inaccurate concentration

## Chlorhexidine Gluconate (“CHG”)

- Broadly available at **2% and 4%** soaps for washing hands and skin antiseptics.
- **DO NOT USE 1%, 2% or 4%** on open wounds. Diluted solution is not sterile and has **irritating detergent agents**.
- Available in **0.05% pre-mixed, no additives**
- Extensive data showing 0.05% CHG is safe and well tolerated in **multiple tissues**, and on **burns**.
- Available as a **sterile** packaged device.
- Available as a compressible bottle for **pressurized** irrigation.

# Efficacy of Antiseptic Solutions on Bacteria and Biofilm

## Bacteria:

- **0.05% CHG and 10% PVP-I** both effective against microbes that cause infection in traumatic wounds, ~1 minute dwell time
- PVP-I is inactivated in presence of organic matter (blood)
- CHG has unique ability to bind to tissue proteins leading to prolonged activity.

## Biofilm:

### Mayo Clinic Study:

- *“Chlorhexidine is capable of eradicating Staph. from Biofilm in vitro in clinically relevant concentrations and exposure times...”*
- *Povidone-Iodine (PVP-I) (and others) were not.”*

## Efficacy of Antiseptic Irrigation Solutions- Clinical Use

There is no data on use of antiseptic solutions specifically in humanitarian emergencies, however...

- **0.05% CHG** has been used extensively in **high risk/high infection (surgical)** wound procedures, showing **infection reduction of up to 50% to 80%**, such as orthopedics, colorectal, plastics reconstruction, ileostomy, and C-sections.
- **10% PVP-I** has also been used extensively on dermal wounds as well as diluted for surgical use. However, a recent 2019 orthopaedic study at Mayo Clinic with 11,738 cases using diluted 0.25% PVP-I demonstrated no infection reduction when compared to saline.



# Commercial Availability of Antiseptic Solutions

**POVIDONE IODINE  
(PVP-I), 10%**

**Brand Name:  
Betadine®**

FDA Cleared for Minor  
Cuts, Scrapes, and burns



**CHLOREXIDINE  
GLUCONATE (CHG), 0.05%**

**Brand Name:  
Irrisept®**

FDA cleared as a **device**, for wound  
debridement and cleansing

- **Sterile-Packaged**, 450 mL **volume**
- Pre-Mixed for optimal **concentration** and **pressure**
- Used in ~2 million procedures, for broad array of wound procedures.



## Next Steps, Call to Action

### Next Steps: Engage All Staff - Multidisciplinary Commitment

- Understand the implications of wound infection
- *Download and share* the foundational protocols and published guidelines
- Understand the benefit of **effective wound debridement, irrigation, & wound care**

### Call to Action: Cross-Sector Collaboration to Share and Build Evidence

1. Build evidence specific to acute traumatic wounds in humanitarian response settings
2. **Global collaboration** to evaluate innovative interventions that are supported with **evidence** from other sectors

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