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INFECTION CONTROL – CLINICAL DECISION-MAKING THROUGH AN ANTIMICROBIAL PATHWAY

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Journal of Community Nursing JCN

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SUPPORTING CLINICAL DECISION-MAKING THROUGH AN INFECTION MANAGEMENT PATHWAY

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Learning objectives

At the end of this session you will be able to:

- Identify what wound infection is
- Understand the risk factors associated with wound infection
- Identify the signs and symptoms of wound infection
- Understand the wound infection continuum and wound biofilm
- Understand how to diagnose wound infection
- Identify the components of effective wound infection management
- Describe a pathway of care.

Introduction

Wound infection can be financially costly to healthcare organisations and can negatively affect quality of life for patients, families and carers due to:

- Pain
- Malodour
- Frequent dressing changes
- Loss of appetite
- Malaise
- Deterioration of blood glucose control in people with diabetes.

(WUWHS, 2008)

Introduction

It is essential that clinicians are able to:

- Identify wound infection correctly and, when appropriate, choose the right topical antimicrobial and/or systemic treatment, with the goals of preventing or eradicating infection and promoting wound healing.

(Wounds UK, 2013)

What is wound infection?

Wound infection has been defined as:

The invasion of a wound by proliferating microorganisms to a level that evokes a local and/or systemic response in the host.

(International Wound Infection Institute [IWII], 2016)

Impact of wound infection

Impact of wound infection

Living with a wound, especially if it is chronic, also has a huge impact on patient quality of life and wellbeing with wound infection being the most troubling of all wound complications, which can even be fatal (Wounds UK, 2013).

The literature supports the most common concerns being:

- Increased pain
- Swelling
- Purulent malodorous discharge.

Impact of wound infection

These can lead to:

- Social isolation
- Depression
- Feelings of guilt
- Repulsion

(Ousey et al, 2017)

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Risk factors associated with wound infection

Characteristics of the individual, their wound and its environment can contribute to the development of infection.

(International Wound Infection Institute [IWII], 2016)

Risk factors — the individual

Characteristics of the individual:

- Poorly controlled diabetes
- Radiotherapy/chemotherapy
- Conditions associated with hypoxia and/or poor tissue perfusion
- Immune system disorders
- Inappropriate antibiotic prophylaxis, particularly in acute wounds
- Protein-energy malnutrition
- Alcohol, smoking, drug abuse.

Risk factors — the wound

Characteristics of the wound

Acute wounds:

- Contaminated or dirty wounds
- Trauma with delayed treatment
- Pre-existing infection or sepsis.

- Chronic wounds:
  - Duration of the wound
  - Large wound area
  - Deep wound.

- Both wound types:
  - Foreign body
  - Haematoma
  - Necrotic wound tissue
  - Impaired tissue perfusion
  - Increased exudate or moisture.

Risk factors — the environment

- Characteristics of the environment:
  - Hospitalisation
  - Poor hand hygiene and aseptic technique
  - Unhygienic equipment
  - Inadequate management of moisture, exudate and oedema
  - Inadequate pressure off-loading
  - Repeated trauma.

Signs and symptoms

Signs and symptoms of local and systemic infection vary, while chronic wounds often behave differently.

Local wound infection

Signs of local infection include (Rutter, 2018):

- Heat
- Redness
- Inflammation
- Oedema
- Increased volume of exudate
- Malodour
- Increase in wound size/volume
- Change in the nature of pain experienced by the patient.

Systemic infection

Signs of systemic infection include (Rutter, 2018):

- Pyrexia
- Tachycardia
- Tachypnoea
- Lethargy/malaise.

Chronic wounds

Signs of infection in chronic wounds include (Rutter, 2018):

- Discoloration of tissue in the wound bed
- Bleeding or friable granulation tissue
- Pocketing or undermining in the wound bed
- Bridging in the wound bed.

Remember

There are some wound types which may not display the clinical signs and symptoms of infection, e.g. patients with diabetes or neuropathy who have a reduced inflammatory response (Gottrup et al, 2013).

The infection continuum

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Signs and symptoms associated with stages of the wound infection (IWII, 2016)

Contamination	Colonisation	Local	Spreading	Systemic
All wounds may acquire micro-organisms If the conditions are not suitable they will not multiply Wound healing will not be delayed	Microbial species grow successfully but do not cause damage to the host or initiate wound infection			

Signs and symptoms associated with stages of the wound infection (IWII, 2016)

Contamination	Colonisation	Local		Spreading	Systemic
All wounds may acquire micro-organisms If the conditions are not suitable they will not multiply Wound healing will not be delayed	Microbial species grow successfully but do not cause damage to the host or initiate wound infection	Subtle: Overgranulation Bleeding/friable Bridging/ pocketing Wound breakdown Delayed healing New or increased pain Increasing malodour	Classic: Erythema Local warmth Swelling Purulent discharge Delayed wound healing New or increased pain Increasing malodour		

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No antimicrobials indicated		Topical antimicrobials		Systemic and topical antimicrobials	

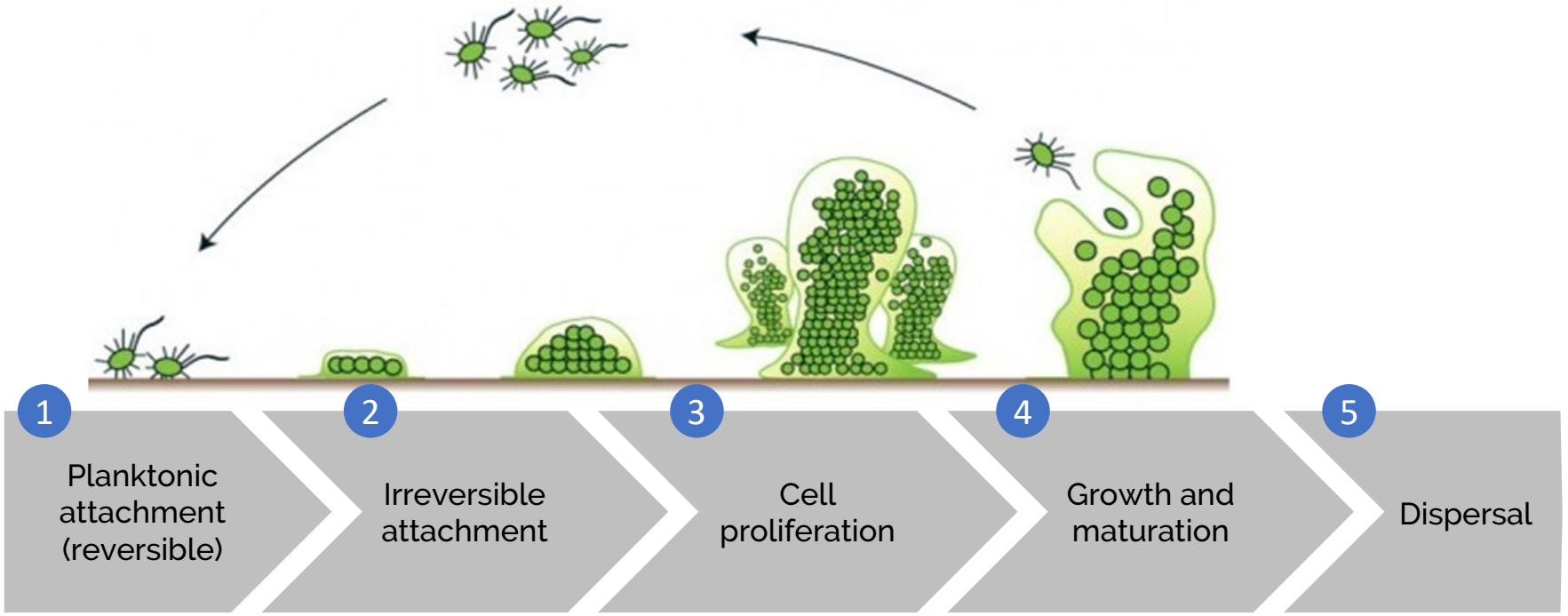
Wound biofilm

Planktonic bacteria vs biofilm bacteria

- Bacteria exist in one of two states — free floating (planktonic) or attached to a surface (sessile)
- Bacteria routinely shift from one state to the other in an ongoing cycle
- Micro-organisms prefer to be attached to a surface
- This is because it offers a source of nutrients, protection and the safety of a community

What is a biofilm?

5 stages of biofilm formation



Surface-adherent bacteria, encased within and protected by an extracellular polymeric substance (EPS)

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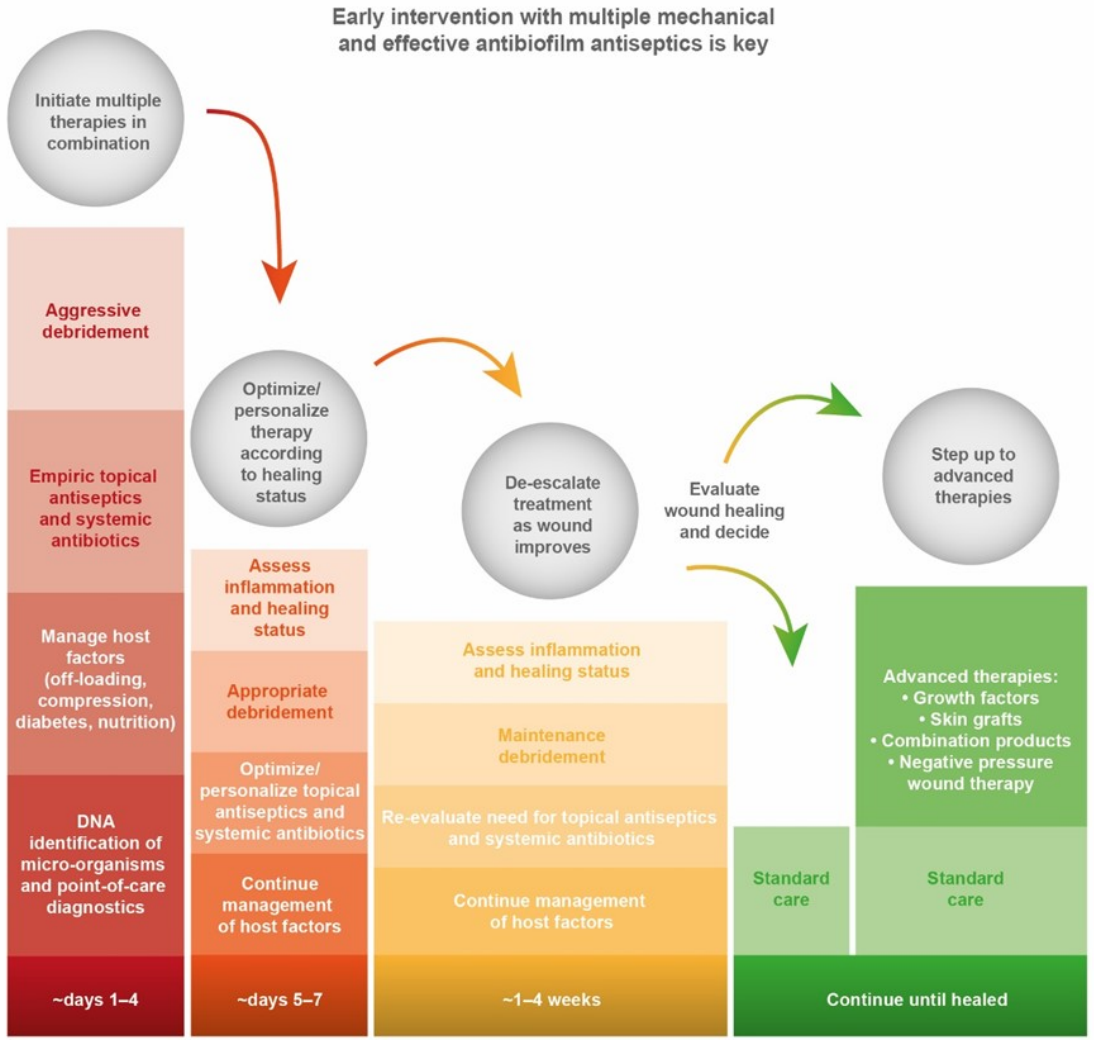
How quickly does a biofilm form?

Planktonic bacteria typically (Percival, 2017):

- Attach within minutes
- Form attached micro colonies within 2–4 hours
- Develop initial extracellular polymeric substance and are tolerant to biocides within 6–12 hours
- Evolve into mature biofilm colonies within 2–4 days
- Rapidly recover from mechanical disruption and re-form mature biofilm within 24 hours.

Early intervention with multiple mechanical and effective antibiofilm antiseptics is key



Then de-escalate as wound improves

1. Schultz et al. Wound Repair Regen. 2017;25:744-757

Diagnosing wound infection

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Diagnosing wound infection

- The first step is to understand the risk factors, and the signs and symptoms
- The diagnosis is based on a holistic patient assessment
- Clinical assessment can be supplemented by:
  - Microbiological investigations
  - Blood tests
  - Imaging.

Microbiology should not be undertaken routinely or without substantial cause.

Effective management of wound infection

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Effective management of wound infection

- Effective wound management requires a holistic assessment
- Management strategies can be split into three sections (IWII, 2016):
  - Optimising an individual's host response
  - Reducing wound microbial load
  - Promoting environmental and general measures.

Optimising an individual's host response

- Optimising comorbidities, e.g. diabetic control
- Minimising or eliminating risk factors where possible
- Optimising nutritional status and hydration
- Treating systemic symptoms, e.g. pain, pyrexia
- Using appropriate antimicrobial therapy
- Providing psychological support.

Reducing wound microbial load

- Prevent cross infection
- Ensure periwound hygiene and protection
- Manage wound exudate
- Optimise wound bed
  - Wound bed preparation/debridement
  - Disrupt biofilm
- Use appropriate dressings to manage exudate
  - An antimicrobial may be considered
  - If considered necessary, for a short period only, e.g. two weeks.

Reduce wound microbial load

Debridement

- Surgical
- Conservative/sharp
- Autolytic
- Mechanical
- Enzymatic/chemical/ surfactant
- Biosurgical/larval therapy.

Topical antimicrobial

- Silver (nanocrystalline, salts and ionic)
- Iodine (cadexomer and povidone)
- Honey
- Polyhexamethylene biguanide (PHMB).

Promote environmental and general measures

- Perform wound care in a clean environment
- Appropriate technique depending on risk assessment
- Correct storage of equipment and supplies
- Appropriate and timely dressing regimen
- Education for the patient and care giver
- Follow local policies and procedures.

Pathways of care

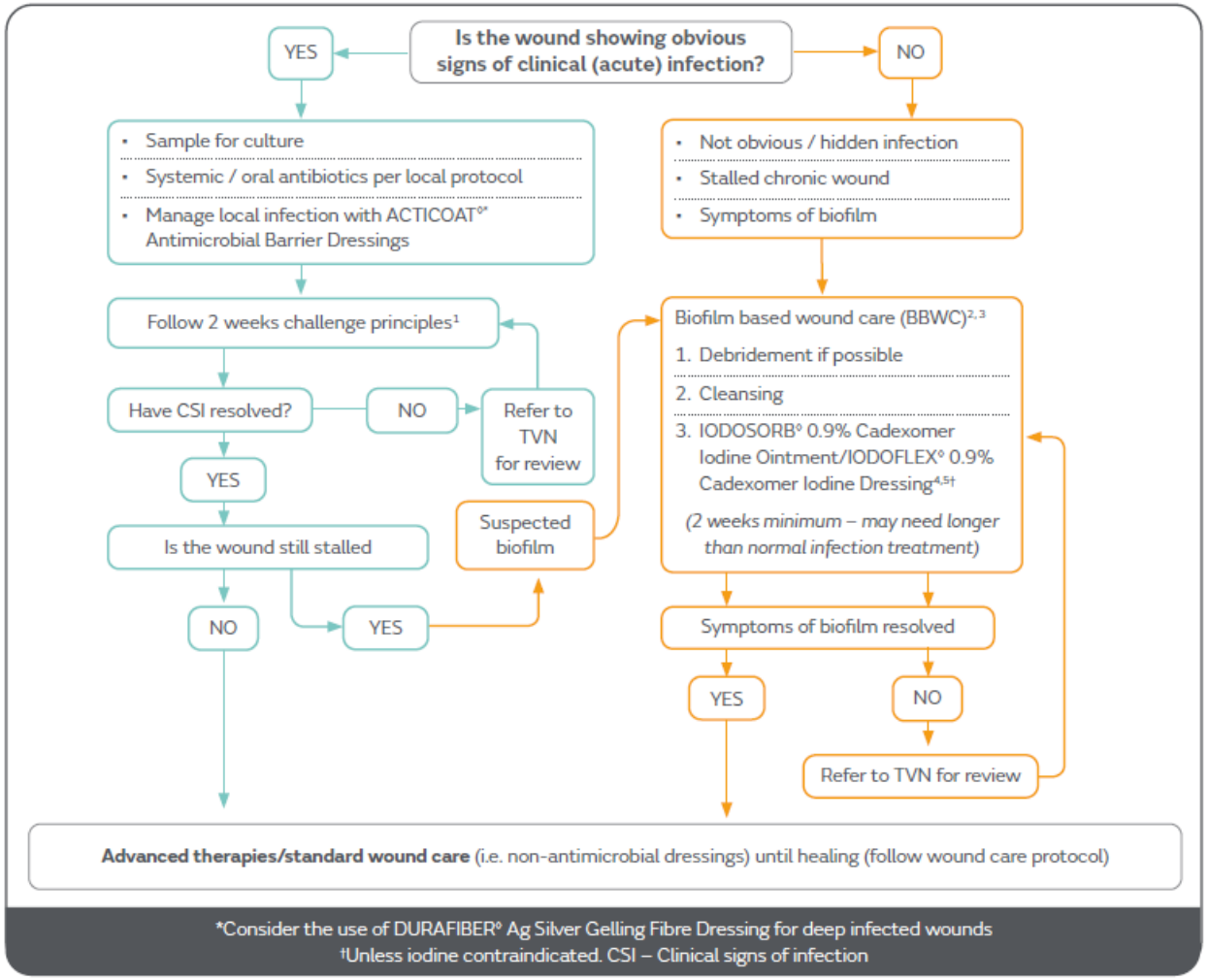
Pathways of care can be a useful way to standardise the management approach across an organisation.

Reduce healthcare costs through effective decision-making

We understand your priority is to identify and manage barriers to healing, allowing the wound to progress to closure.

The International Consensus 2012 recommends using antimicrobial dressings for two weeks initially before re-assessment and a decision to stop or continue use.[1]

A pathway to guide appropriate treatment of local infection and biofilm



1. Ayello EA, et al. International consensus. Appropriate use of silver dressings in wounds. An expert working group consensus. Wounds Int. 1–24 (2012)
2. Wolcott RD, et al. Chronic wounds and the medical biofilm paradigm. J. Wound Care 19, 45–6, 48–50, 52–3 (2010).
3. Schultz G, et al. Consensus guidelines for the identification and treatment of biofilms in chronic nonhealing wounds. Wound Repair Regen. 25, 744–757 (2017).
4. Roche ED, et al. Cadexomer iodine effectively reduces bacterial biofilm in porcine wounds ex vivo and in vivo. Int. Wound J. 1–10 (2019). doi:10.1111/iwj.13080.
5. Malone M, et al. Effect of cadexomer iodine on the microbial load and diversity of chronic non-healing diabetic foot ulcers complicated by biofilm in vivo. J. Antimicrob. Chemother. 72, 2093–2101 (2017)

Case 1 : DFU with biofilm...

- Non-surgical management of a deep DFU with persistent chronic infection
- Biofilm-based wound care implemented
- IODOSORB used to prepare wound bed/disrupt biofilm
- DFU wound healed week 14

Abbreviations:

HRFS = high risk foot service;
SEM = scanning electron microscopy.

All images provided courtesy of Dr. Matthew Malone and Ms. Saskia Schwarzer.

1. Malone M, Schwarzer S. T.I.M.E. to say goodbye to non-healing chronic wounds. A case series of diabetic foot ulcer management. Smith & Nephew case series. (2019).
2. Schultz GS, Sibbald RG, Falanga V et al., Wound Rep Reg (2003);11:1-28.
3. Leaper DJ, Schultz G, Carville K, Fletcher J, Swanson T, Drake R. Extending the TIME concept: what have we learned in the past 10 years? Int Wound J 2012; 9 (Suppl. 2):1–19.

Week 1

Step 1: Patient and wound assessment

- Full medical history and visual observations were performed (Image A)
- Patient was provided with lower limb compression therapy on the left leg and a postoperative shoe

Step 2: Identification

- Tissue biopsy identified MRSA
- SEM of tissue punch biopsy confirmed biofilm presence (Image B)

Step 3: T.I.M.E.[2,3] - Tissue

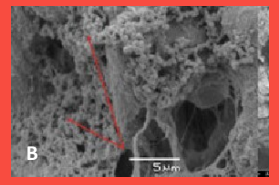
- Aggressive scalpel debridement to remove non-viable infected tissue twice weekly at the HRFS and once weekly by community nursing

Step 4: T.I.M.E.[2,3] - Infection

- Wound cleansing immediately after debridement: 15 min with chlorhexidine and cetrimide
- IODOSORB® Ointment was left in place for up to 2 days during each application
- Oral antibiotics were continued

Step 5: T.I.M.E.[2,3] - Moisture balance

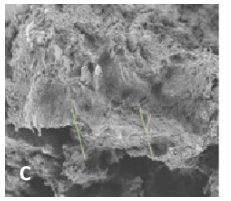
- ALLEVYN® NON-ADHESIVE Dressing was applied as a secondary dressing to control excess exudate



Week 2

Wound monitoring and reassessment

- Clinical signs of biofilm infection were improving and SEM confirmed biofilm reduction (Image C)



- Ongoing aggressive treatment was still required
- Continued Week 1 wound care regime with two debridements at the HRFS, cleansing with chlorhexidine and cetrimide and application of IODOSORB Ointment

Week 6

Step 6: T.I.M.E.[2,3] - Edge of wound

- Observation and tissue biopsy showed improvements in wound bed:

- Ongoing aggressive treatment was still required
- Continued Week 1 wound care regime with two debridements at the HRFS, cleansing with chlorhexidine and cetrimide and application of IODOSORB Ointment

Week 12

Wound monitoring and reassessment

- DFU was epithelialising and close to closure (Image E)
- ALLEVYN NON-ADHESIVE Dressing was used in combination with compression garments for oedema control

Week 14

Wound monitoring and reassessment

- DFU had healed

Case 2: Use of ACTICOAT◊ FLEX 3 Antimicrobial Barrier Dressing on a chronic dehisced abdominal incision (acute infection)

- 52-year-old male with no significant medical history
- Following surgery, the patient's incision dehisced superficially and was classified as grade 2a (WUWH guidance)
- After 10 months of multiple silver dressings, the wound measured 4x4cm with undermining remaining at a depth of 7cm. Post washout and debridement, treatment was changed to a gelling fiber dressing, with daily dressing changes

Image not of patient discussed on this slide. Copyright ResearchGate: https://www.researchgate.net/figure/Preoperative-photograph-of-abdominal-wound-Preoperative-state-shows-wound-dehiscence-due_fig1_235383750

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Use of ACTICOAT◊ FLEX 3 Antimicrobial Barrier Dressing on a chronic dehisced abdominal incision

- The TV team reviewed the wound again one month later and changed treatment to ACTICOAT◊ FLEX 3 Antimicrobial Barrier Dressing
- By week two of ACTICOAT◊ FLEX 3 treatment, the depth of the wound reduced from 7cm to 4.5cm; dressing changes had reduced from daily, to twice weekly, and the patient's mood had improved
- At week three of ACTICOAT◊ Flex 3 treatment, the TV team advised PICO◊ 7 single use Negative Pressure Wound Therapy (sNPWT) with Kerlix™ gauze packing be implemented
- Six weeks after the implementation of ACTICOAT◊ FLEX 3 treatment, and one year of the patient living with the wound, the wound had completely healed.

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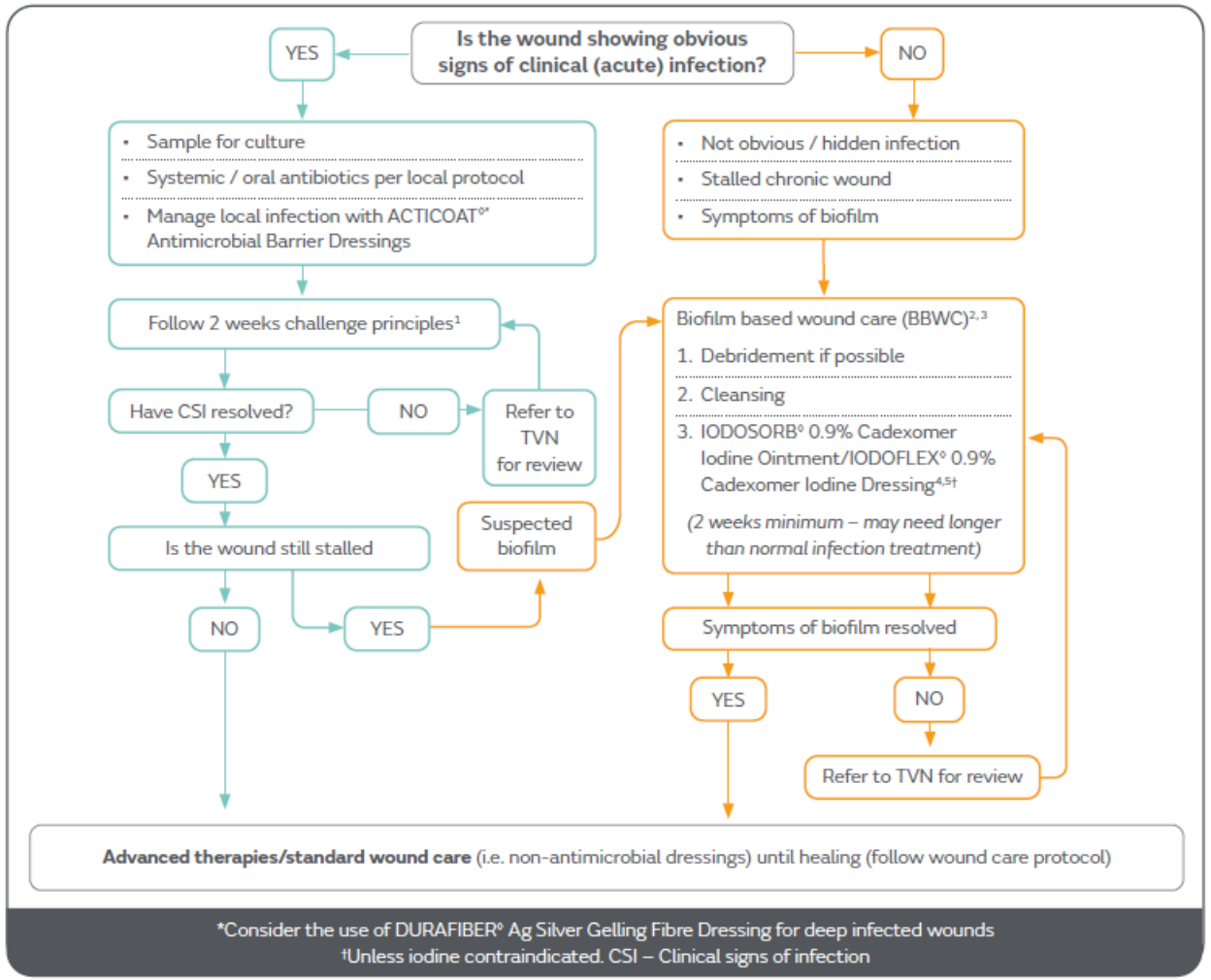
Conclusion

- Wound infection can be financially costly to healthcare organisations and can have a detrimental effect on the quality of life for patients, families and their carers
- Having the skills and confidence to identify the early signs and symptoms of wound infection is important to initiate timely intervention
- Pathways of care can be a useful way to standardise the management approach across an organisation and, in so doing, improve the care patients receive.

Choose the right product, at the right time, for the right patient

A pathway to guide appropriate treatment of local infection and biofilm



Download your copy of the Infection Management Pathway from the Smith+Nephew website today:

https://www.smith-nephew.com/uk/products/wound_management/product-search/infection-management/

1. Ayello EA, et al. International consensus. Appropriate use of silver dressings in wounds. An expert working group consensus. Wounds Int. 1–24 (2012)
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