Professional Certificate in Advanced Wound Care

Wound Infection and Biofilm Management

Acute wound infection – A rapid onset of microbial colonisation that leads to clinical signs such as erythema, warmth, pain and purulent discharge. Related terms: cellulitis, sepsis. It typically follows trauma or surgery and requires prompt antimicrobial therapy. Practical application includes early wound assessment and culture. Challenges involve distinguishing colonisation from true infection in the early stages.

Biofilm – Structured community of microorganisms encased in a self-produced extracellular polymeric substance (EPS) attached to a wound surface. Related terms: extracellular matrix, quorum sensing. Biofilms protect bacteria from host defenses and antibiotics, leading to chronic infection. Example: Pseudomonas aeruginosa forming a thick, greenish layer on a diabetic foot ulcer. Management strategies include debridement, anti-biofilm agents, and adjunctive therapies. Challenges include incomplete removal and recurrence.

Biofilm disruption agents – Substances designed to break down the EPS matrix, enhancing antimicrobial penetration. Related terms: enzymatic debridement, surfactants. Common agents include lactoferrin, DNase, and certain chelators. Practical use involves topical application after thorough cleansing. Challenges include ensuring agent stability and avoiding cytotoxicity to healthy tissue.

Chronic wound infection – Persistent infection lasting >6 weeks, often associated with biofilm and impaired healing. Related terms: non-healing ulcer, osteomyelitis. Clinical indicators include delayed granulation, foul odor, and increased exudate. Example: A long-standing venous ulcer with intermittent drainage. Management requires long-term antimicrobial therapy, repeated debridement, and optimisation of perfusion. Challenges involve antibiotic resistance and patient compliance.

Colonisation – Presence of microorganisms on a wound surface without causing tissue damage or clinical signs of infection. Related terms: normal flora, bioburden. Up to 10^5 CFU/g may be present without jeopardising healing. Differentiating colonisation from infection is essential to avoid unnecessary antibiotics. Practical approach includes monitoring for changes in wound appearance. Challenges arise when colonisation progresses to biofilm formation.

Clinical signs of infection – Observable indicators that suggest pathogenic activity in a wound. Related terms: pain, erythema. Classic signs include increased pain, redness extending >2 cm, warmth, swelling, purulent exudate, and delayed granulation. Example: A surgical incision that becomes hot and tender on postoperative day 3. Accurate documentation guides treatment decisions. Challenges include atypical presentations in immunocompromised patients.

Companion diagnostics – Laboratory tests that accompany antimicrobial selection, such as rapid PCR for

resistant genes. Related terms: point-of-care testing, antibiogram. They provide timely information to tailor therapy, reducing broad-spectrum use. Practical application includes using a wound swab PCR panel to detect MRSA. Challenges involve cost, accessibility, and interpretation of mixed-flora results.

Debridement – Mechanical or enzymatic removal of devitalised tissue, biofilm, and foreign material. Related terms: sharp debridement, autolytic debridement. Types include surgical, mechanical, enzymatic, autolytic, and biological (e.G., Maggot therapy). Example: Using a scalpel to excise necrotic tissue from a pressure ulcer. Debridement reduces bacterial load and promotes granulation. Challenges include pain management, bleeding risk, and ensuring complete removal of biofilm.

Enzymatic debridement – Use of proteolytic enzymes to dissolve necrotic tissue and biofilm. Related terms: collagenase, fibrinolysin. Products such as collagenase ointment selectively target dead tissue while sparing viable cells. Practical application involves applying the enzyme to a moist wound for 24-48 hours. Challenges include cost, potential allergic reactions, and the need for regular dressing changes.

Exudate management – Controlling the volume, composition, and odor of wound fluid to prevent maceration and infection. Related terms: absorbent dressings, negative pressure wound therapy. Strategies include selecting appropriate dressings (e.G., Alginate for heavy exudate) and monitoring for signs of infection. Example: Switching from a hydrocolloid to a foam dressing when exudate increases. Challenges involve balancing moisture retention for healing while avoiding excess that promotes bacterial growth.

Foul odor – Unpleasant smell emanating from a wound, often indicating anaerobic infection or necrosis. Related terms: malodor, anaerobes. Odor is produced by volatile sulfur compounds from bacterial metabolism. Practical assessment includes sniffing the wound during dressing changes. Management may involve thorough cleansing, debridement, and targeted antibiotics. Challenges include patient embarrassment and difficulty quantifying odor severity.

Gram-positive bacteria – A group of microorganisms that retain crystal violet stain, including Staphylococcus aureus and Streptococcus pyogenes. Related terms: cocci, beta-lactam antibiotics. These organisms are common culprits in acute wound infections. Example: MRSA causing a post-operative incision infection. Treatment often involves agents such as vancomycin or linezolid. Challenges involve resistance patterns and biofilm formation.

Gram-negative bacteria – Rod-shaped organisms that appear pink after Gram staining, such as Pseudomonas aeruginosa and Escherichia coli. Related terms: rod-shaped, extended-spectrum β-lactamases. Frequently isolated from chronic wounds and are adept at forming biofilms. Example: A moist foot ulcer colonised by P. Aeruginosa producing a green pigment. Management may require antipseudomonal agents like ciprofloxacin. Challenges include multidrug resistance and rapid adaptation.

Host immune response – The body's innate and adaptive mechanisms that attempt to eradicate pathogens in a wound. Related terms: neutrophils, macrophage activation. Effective response includes phagocytosis, cytokine release, and angiogenesis. In compromised hosts (e.G., Diabetes), this response is blunted, leading

to persistent infection. Practical implication is the need for adjunctive therapies that support immunity. Challenges involve systemic factors that cannot be corrected locally.

Infection control protocols – Standardised procedures to prevent cross-contamination and spread of pathogens in clinical settings. Related terms: hand hygiene, sterile technique. Protocols include using gloves, aseptic dressing changes, and environmental cleaning. Example: Employing a “no-touch” technique when applying a dressing to a colonised wound. Adherence reduces healthcare-associated infections. Challenges include staff compliance and resource limitations.

Isothermal amplification – Molecular technique that amplifies DNA at a constant temperature, used for rapid pathogen detection. Related terms: LAMP, point-of-care PCR. It can identify resistant genes within minutes, guiding early antimicrobial choices. Practical use includes bedside testing for MRSA in a wound swab. Challenges involve assay specificity and the need for trained personnel.

Keratinocyte migration – Movement of epidermal cells across a wound bed, essential for re-epithelialisation. Related terms: epithelialisation, growth factors. Infection and biofilm impede migration by releasing cytotoxic metabolites. Example: A clean, moist ulcer allowing rapid keratinocyte advance. Therapeutic focus includes reducing bacterial load to restore migration. Challenges include chronic inflammation that continually disrupts the process.

Laser therapy – Use of specific wavelengths to exert antimicrobial or biofilm-disrupting effects. Related terms: photodynamic therapy, low-level laser. Certain lasers can generate reactive oxygen species that damage bacterial cells. Practical application involves applying a laser probe to a wound after debridement. Evidence suggests adjunctive benefit in reducing bacterial counts. Challenges include equipment cost and need for trained operators.

Low-frequency ultrasound – Mechanical energy delivered to a wound to dislodge biofilm and promote tissue granulation. Related terms: ultrasound debridement, sonophoresis. The cavitation effect can disrupt EPS, enhancing antibiotic penetration. Example: Using a handheld ultrasound device on a chronic venous ulcer twice weekly. Benefits include reduced dressing changes. Challenges involve contraindications such as exposed vessels and patient discomfort.

Matrix metalloproteinases (MMPs) – Enzymes that degrade extracellular matrix components, often elevated in infected wounds. Related terms: proteolysis, tissue inhibitors of metalloproteinases. Excessive MMP activity impairs healing and can liberate bacterial nutrients. Practical approach includes using MMP-modulating dressings (e.G., Those containing protease inhibitors). Challenges involve balancing necessary remodeling with over-degradation.

Microbial load – Quantity of viable organisms present in a wound, expressed as colony-forming units per gram (CFU/g). Related terms: bioburden, quantitative culture. Loads >10^5 CFU/g often correlate with infection, while lower counts may represent colonisation. Example: A swab yielding 1 × 10^6 CFU/g of Staphylococcus aureus. Management includes reducing load through debridement and antimicrobial

therapy. Challenges include sampling technique variability.

Negative pressure wound therapy (NPWT) – Application of sub-atmospheric pressure to a wound via a sealed dressing and vacuum pump. Related terms: vacuum assisted closure, macrodeformation. NPWT removes exudate, reduces edema, and can help disrupt biofilm by mechanical forces. Practical use includes placing a foam dressing over a deep pressure ulcer and applying continuous -125 mmHg pressure. Benefits include faster granulation. Challenges involve ensuring seal integrity and avoiding tissue damage.

Neutrophil extracellular traps (NETs) – Web-like structures released by activated neutrophils that trap and kill microbes. Related terms: NETosis, extracellular DNA. While NETs are protective, excessive formation can contribute to chronic inflammation and impede healing. Example: NETs observed in a heavily inflamed diabetic foot ulcer. Therapeutic strategies aim to modulate NET formation without compromising antimicrobial activity. Challenges include limited clinical tools to assess NETs in wounds.

Nosocomial infection – Infection acquired within a healthcare facility, often involving resistant organisms. Related terms: hospital-acquired infection, MRSA. Wound sites are common portals for these pathogens. Example: A postoperative wound infected with vancomycin-resistant Enterococcus. Prevention relies on strict infection control and antimicrobial stewardship. Challenges include rising prevalence of multidrug-resistant strains.

Oxygen therapy – Supplemental delivery of oxygen to enhance wound healing and support immune function. Related terms: hyperbaric oxygen, topical oxygen. Increased oxygen tension improves neutrophil killing and fibroblast activity. Practical application includes intermittent hyperbaric sessions for chronic osteomyelitis. Challenges involve accessibility, cost, and contraindications such as untreated pneumothorax.

Oxidative stress – Imbalance between reactive oxygen species (ROS) production and antioxidant defenses in wound tissue. Related terms: free radicals, antioxidant therapy. Persistent infection can elevate ROS, damaging cells and extracellular matrix. Example: Elevated malondialdehyde levels in a chronic ulcer. Management may incorporate antioxidant dressings (e.G., Containing vitamin C). Challenges include ensuring adequate ROS for bacterial killing while protecting host tissue.

Pathogen-specific antimicrobial stewardship – Tailoring antibiotic use based on identified organisms and resistance patterns. Related terms: de-escalation, targeted therapy. This approach reduces unnecessary broad-spectrum exposure and limits resistance development. Practical steps include switching from empirical vancomycin to oral doxycycline after culture confirmation of MSSA. Challenges involve timely receipt of culture results and clinician adherence.

Peri-wound skin assessment – Evaluation of the skin surrounding a wound for signs of maceration, erythema, or infection spread. Related terms: periwound, skin integrity. Healthy periwound tissue is crucial for overall healing. Example: Noting erythema extending 1 cm beyond the ulcer margin, indicating possible cellulitis. Interventions may include barrier creams and appropriate dressing choice. Challenges include differentiating peripheral inflammation from systemic infection.

Polymicrobial infection – Presence of multiple bacterial species, often synergistically worsening wound pathology. Related terms: mixed flora, biofilm synergy. Common in chronic ulcers where anaerobes coexist with aerobes. Example: A diabetic foot ulcer yielding Staphylococcus aureus, Pseudomonas aeruginosa, and Bacteroides fragilis. Treatment may require combination therapy and aggressive debridement. Challenges involve interpreting culture data and avoiding excessive antibiotic use.

Pressure-related ulcer infection – Infection that develops in a pressure ulcer due to compromised perfusion and tissue breakdown. Related terms: decubitus ulcer, ischemic necrosis. Frequently colonised by MRSA or P. Aeruginosa. Practical management includes off-loading, appropriate dressing, and antimicrobial therapy. Challenges include patient mobility, nutrition, and maintaining skin integrity.

Protease-modulating dressings – Dressings formulated to neutralise excess proteases like MMPs, supporting a balanced wound environment. Related terms: hydrogel, silver-impregnated. Products may contain ionic binders or specific inhibitors. Example: Applying a protease-modulating hydrogel to a chronic ulcer with elevated MMP activity. Benefits include reduced tissue breakdown and improved granulation. Challenges involve cost and ensuring compatibility with other topical agents.

Quorum sensing – Bacterial communication system that regulates gene expression based on population density, influencing biofilm formation and virulence. Related terms: autoinducers, signal molecules. Disruption of quorum sensing can attenuate biofilm robustness. Practical application includes using quorum-quenching molecules (e.G., Furanones) as adjuncts. Challenges include limited clinical data and potential off-target effects.

Rapid diagnostic tests – Point-of-care assays that provide quick identification of pathogens or resistance markers. Related terms: lateral flow assay, microfluidic chip. Examples include a cartridge that detects MRSA DNA within 15 minutes. These tests enable early targeted therapy, reducing unnecessary broad-spectrum use. Challenges involve sensitivity, specificity, and integration into workflow.

Re-epithelialisation – Restoration of the epidermal layer across a wound surface. Related terms: epithelial migration, keratinocyte proliferation. Successful re-epithelialisation requires a clean, low-bioburden environment. Example: A superficial abrasion achieving complete closure within 7 days after infection control. Strategies to promote this include moist dressings and minimizing infection. Challenges arise when persistent biofilm impedes cell migration.

Resistance gene profiling – Molecular analysis that identifies specific antimicrobial resistance determinants (e.G., MecA, blaKPC). Related terms: genotypic testing, genomic sequencing. Provides clinicians with precise data for antibiotic selection. Practical use includes ordering a PCR panel for a wound swab to detect methicillin resistance. Challenges include interpreting mixed-population results and the need for confirmatory phenotypic testing.

Scalp wound infection – Infection occurring on the scalp, often after trauma or surgery, with unique considerations due to hair density. Related terms: folliculitis, alopecia. Presents with pustules, erythema, and

possible hair loss. Management includes gentle cleansing, appropriate antibiotics, and avoidance of hair-pulling trauma. Challenges involve maintaining hygiene in a hair-rich environment and potential for deep-seated infection.

Septicemia – Systemic inflammatory response to infection, where pathogens or toxins enter the bloodstream from a wound. Related terms: sepsis, bacteremia. Symptoms include fever, tachycardia, hypotension, and organ dysfunction. Example: A postoperative wound infection progressing to septic shock. Immediate broad-spectrum antibiotics and source control (e.G., Wound debridement) are critical. Challenges include rapid identification, resistance, and patient comorbidities.

Silver-based dressings – Topical products containing ionic silver that provide broad-spectrum antimicrobial activity. Related terms: nanocrystalline silver, silver sulfadiazine. Silver disrupts bacterial cell walls and interferes with DNA replication. Practical use includes applying a silver-impregnated foam to a moist ulcer with moderate infection. Benefits include reduced bacterial counts without systemic toxicity. Challenges involve potential cytotoxicity at high concentrations and silver resistance.

Skin substitute infection – Infection occurring within or beneath a bioengineered skin graft. Related terms: allograft, biologic dressing. These materials can become colonised, compromising graft take. Example: A bilayered skin substitute developing purulent drainage after placement. Management includes removal of infected tissue, targeted antibiotics, and possibly re-grafting. Challenges include distinguishing graft infection from surrounding wound infection and preserving viable tissue.

Standardised wound sampling – Protocols for obtaining representative specimens (e.G., Swab, tissue biopsy) to guide microbiological analysis. Related terms: Levine technique, quantitative culture. Proper sampling reduces false-negative results and improves therapeutic accuracy. Practical steps involve cleaning the wound, applying a sterile swab with firm rotation over the base, and transporting promptly. Challenges include practitioner variability and patient discomfort.

Staphylococcus aureus – Gram-positive cocci, a common cause of acute and chronic wound infections. Related terms: MSSA, MRSA. Virulence factors include protein A, toxins, and biofilm-forming ability. Example: A postoperative incision infected with methicillin-susceptible S. Aureus presenting with purulent drainage. First-line therapy often includes oxacillin or cefazolin; MRSA requires vancomycin or linezolid. Challenges involve resistance development and biofilm persistence.

Standard precautions – Universal infection control measures applied to all patient interactions, regardless of known infection status. Related terms: universal precautions, personal protective equipment. Include hand hygiene, gloves, masks, and safe sharps disposal. In wound care, these precautions minimise cross-contamination between patients. Practical implementation involves using a new pair of gloves for each dressing change. Challenges include compliance fatigue and resource constraints.

Systemic antibiotic therapy – Administration of antimicrobial agents via oral or intravenous routes to treat wound infection. Related terms: pharmacokinetics, antibiotic stewardship. Choice depends on organism,

severity, patient factors, and tissue penetration. Example: IV ceftriaxone for a severe cellulitis extending from a surgical wound. Monitoring includes renal function and therapeutic drug levels when indicated. Challenges involve adverse effects, drug interactions, and emergence of resistance.

Targeted antimicrobial delivery – Techniques that concentrate antibiotics at the wound site, reducing systemic exposure. Related terms: local antibiotic beads, nanoparticle carriers. Examples include calcium sulfate beads loaded with vancomycin placed in a debrided cavity. Benefits include high local concentrations and lower systemic toxicity. Challenges involve achieving sustained release, potential local tissue irritation, and cost.

Thermal debridement – Use of controlled heat (e.G., Electrosurgery) to remove necrotic tissue and disrupt biofilm. Related terms: cautery, laser ablation. Provides rapid tissue removal but may cause collateral thermal injury. Practical use includes using a monopolar cautery to excise slough in a pressure ulcer. Benefits include immediate visual control of bleeding. Challenges include depth control and postoperative pain.

Topical antimicrobial agents – Substances applied directly to the wound surface to reduce microbial burden. Related terms: iodine, chlorhexidine. Options range from antiseptic solutions to antibiotic ointments. Example: Applying 0.5 % Chlorhexidine solution to a clean wound before dressing. Advantages include localized effect and minimal systemic impact. Challenges include potential cytotoxicity, allergic reactions, and selection of resistant organisms.

Trauma-related wound infection – Infection arising after an acute injury such as lacerations, burns, or animal bites. Related terms: open fracture, dirty wound. Often involves mixed flora and a high risk of tetanus. Example: A contaminated dog bite on the hand developing erythema and purulent drainage within 48 hours. Management includes thorough irrigation, tetanus prophylaxis, and empiric antibiotics covering both aerobic and anaerobic organisms. Challenges include patient adherence and timely presentation.

Ultraviolet (UV) disinfection – Use of UV-C light to inactivate microorganisms on wound surfaces or dressing materials. Related terms: phototherapy, germicidal lamp. UV exposure damages microbial DNA, reducing viable counts. Practical application includes a handheld UV device applied to a cleaned wound before dressing. Benefits are rapid, chemical-free disinfection. Challenges involve limited penetration depth, potential skin irritation, and safety precautions for the operator.

Vascular insufficiency infection – Infection occurring in wounds compromised by poor arterial or venous blood flow. Related terms: ischemic ulcer, chronic venous disease. Reduced perfusion impairs immune cell delivery and antibiotic penetration. Example: A lower-leg ulcer with sluggish capillary refill developing purulent exudate. Management emphasizes revascularisation, compression therapy (when appropriate), and aggressive infection control. Challenges include balancing edema reduction with arterial perfusion and patient tolerance.

Virulence factors – Molecules produced by pathogens that enhance their ability to cause disease, such as

toxins, enzymes, and adhesins. Related terms: exotoxin, adhesin. In wound infection, these factors facilitate tissue destruction and immune evasion. Example: A-hemolysin from S. Aureus lysing host cells. Understanding virulence assists in selecting therapies that neutralise specific mechanisms. Challenges include the diversity of factors across species and limited clinical assays.

Wound bed preparation (WBP) – Systematic approach to optimise the wound environment for healing, often summarised as "TIME": Tissue, Infection/Inflammation, Moisture balance, Edge. Related terms: debridement, infection control. Thorough WBP reduces bioburden, removes necrotic tissue, and creates a moist, granulating base. Example: Applying enzymatic debridement followed by a moisture-balancing dressing. Benefits include accelerated healing and reduced infection risk. Challenges involve coordinating multidisciplinary care and patient-specific factors.

Wound culture interpretation – Process of analysing laboratory results to differentiate colonisation, contamination, and true infection. Related terms: quantitative culture, polymicrobial flora. Clinicians consider organism type, colony count, and clinical context. Example: A wound swab yielding 10^4 CFU/g of coagulase-negative staphylococci in a non-painful ulcer likely represents colonisation. Accurate interpretation guides appropriate antimicrobial use. Challenges include mixed cultures and the time lag for results.

Wound exudate analysis – Laboratory evaluation of wound fluid for proteins, cytokines, and bacterial products. Related terms: biomarker, proteomics. Elevated inflammatory markers may indicate infection, while high growth factor levels suggest healing. Practical use includes measuring lactate dehydrogenase to assess tissue viability. Challenges involve standardisation of collection methods and interpretation variability.

Wound infection scoring systems – Structured tools to quantify infection severity, such as the Infectious Diseases Society of America (IDSA) criteria. Related terms: clinical scoring, risk stratification. Scores incorporate signs, symptoms, and laboratory data to guide treatment intensity. Example: A score of 3 indicating moderate infection prompting oral antibiotics and debridement. Benefits include consistent decision-making. Challenges include inter-rater reliability and applicability across diverse wound types.

Wound irrigation – Mechanical flushing of a wound with sterile solution to dilute and remove debris and bacteria. Related terms: lavage, hydrotherapy. Common solutions include normal saline, antiseptic solutions, or antimicrobial irrigants. Practical technique involves low-pressure (≤15 psi) delivery to avoid tissue damage. Example: Irrigating an open fracture wound with 3 L of saline before closure. Benefits include reduced bacterial load and improved visualization. Challenges involve ensuring thoroughness without promoting maceration.

Wound microbiology laboratory coordination – Collaboration between clinicians and laboratory personnel to optimise specimen handling, testing, and reporting. Related terms: specimen transport, turnaround time. Effective coordination ensures appropriate sampling method, timely processing, and actionable results.

Practical steps include establishing a standardized order set and providing education on sampling techniques. Benefits include reduced inappropriate antibiotic use. Challenges include resource constraints and variable lab capabilities.

Wound negative pressure with instillation (NPWTi) – Combination of vacuum therapy and intermittent delivery of antimicrobial or cleansing solutions. Related terms: instillation therapy, fluid-based NPWT. Instilled fluid can disrupt biofilm and enhance debris removal. Example: Using NPWTi with diluted hypochlorous acid for a chronic sacral ulcer. Advantages include simultaneous drainage and antimicrobial exposure. Challenges include device complexity, dressing changes, and ensuring solution compatibility.

Wound pH monitoring – Assessment of the acidity or alkalinity of wound fluid, which influences bacterial growth and enzyme activity. Related terms: alkaline environment, acidic dressings. Infected wounds often exhibit a higher (alkaline) pH. Practical application includes using pH-sensitive strips or sensors. Adjusting pH with acidic dressings may inhibit bacterial proliferation. Challenges involve accurate measurement and maintaining desired pH over time.

Wound swab technique – Method for obtaining a superficial specimen for culture, commonly the Levine (or Levine-modified) technique. Related terms: Levine method, surface swab. The swab is rotated over a 1 cm^2 area with sufficient pressure to express fluid. Example: Using a sterile cotton swab to sample a superficial ulcer before dressing change. Benefits include ease and minimal invasiveness. Challenges include potential under-sampling of deeper organisms and false-negative results.

Wound tissue oxygenation measurement – Non-invasive assessment of oxygen delivery to wound tissue, using tools such as transcutaneous oximetry. Related terms: TcPO2, oxygen tension. Low values (Wound vacuum sealing – Creation of an airtight environment around a wound using a sealed dressing, essential for effective NPWT. Related terms: seal integrity, occlusive dressing. Proper sealing prevents leaks that reduce negative pressure efficacy. Example: Applying a transparent film over a foam dressing on a distal leg ulcer, ensuring no air entry. Benefits include consistent therapy delivery. Challenges involve achieving seal over irregular anatomy and managing patient movement.