

International Wound Infection Institute – 2012 wound care publication retrospective

January 2012

Manuka honey demonstrates bactericidal effects in *Streptococcus pyogenes* cultures

Honey has broad-spectrum antimicrobial activities, and is reported to inhibit more than 80 different species of bacteria; *Streptococcus pyogenes* is associated with wound infection, thought to be due at least in part to its ability to form biofilms. Maddocks and colleagues¹ at Cardiff Metropolitan University undertook a systematic analysis of the *in vitro* effects of manuka honey against *S. pyogenes* biofilms, finding that medical grade manuka honey demonstrated bactericidal effects in both plankton and biofilm cultures of *S. pyogenes*. Treatment with manuka honey disrupted 24-hour established biofilms and caused cell death and dissociation of cells from the biofilm. A significant reduction in fibronectin binding was seen in cells treated with manuka honey, with an associated reduction in the expression of *sof* and *sfbI* genes encoding two major fibronectin-binding streptococcal surface proteins. The authors conclude that manuka honey inhibits biofilm development and can disrupt established *S. pyogenes* biofilms, and that manuka honey represents a viable alternative treatment in wounds that are infected with *S. pyogenes* and are not responding to systemic and topical treatments.

February 2012

Publication of updated systematic reviews on wound cleansing, wound infection and wound healing

An updated Cochrane review² on the efficacy of water as a wound cleansing agent concluded that tap water is unlikely to be harmful if used to clean wounds, although water quality, wound nature, and the patient's general condition should be taken into consideration. No significant difference in infection and healing rates was found in postoperative wounds cleansed with tap water (patient showered), compared with those that were not cleansed. A second updated Cochrane review,³ on the effectiveness of antibiotic prophylaxis in reducing postoperative wound infection rates in patients undergoing hernia repair, concluded that antibiotic prophylaxis may be useful in preventing wound infection in patients undergoing inguinal hernia repair.

The International Working Group of the Diabetic Foot (IWGDF) released an updated review on wound healing. Ten categories were used for classification: sharp debridement and wound bed preparation with larvae and hydrotherapy; wound bed preparation with antiseptics, applications and dressing products; chronic wound resection; hyperbaric oxygen therapy (HBOT); compression or negative pressure therapy; corrective products in wound biochemistry/cell biology associated with impaired wound healing; application of cells (including platelets and stem cells); bioengineered skin and skin grafts; electrical, electromagnetic, lasers, shockwaves and ultrasound; other systemic therapies. The authors concluded that, apart from HBOT and possibly negative pressure therapy, the published evidence was not strong enough to justify changes to routine clinical practice.⁴

March 2012

The ASEPSIS scoring system for wound infection

A review of the ASEPSIS scoring system (Additional treatment, presence of Serous discharge, Erythema, Purulent exudate, Separation of the deep tissues, Isolation of bacteria, and duration of inpatient Stay) assessed the validity, reliability and sensitivity of the ASEPSIS system in establishing infection severity in non-cardiac-

related surgical wounds. The authors concluded that scoring systems to assess surgical sites for wound infection are limited, with the ASEPSIS system being the only one currently available. As the system is not validated for use with non-sternal wounds, however, they recommended caution when using this system to assess infection in non-cardiac surgical wounds.⁵

April 2012

A higher risk of post-operative healing complications is seen in smokers

Dr Sørensen⁶ analysed 140 cohort studies (479,150 patients) comparing smokers and non-smokers, 24 randomized controlled trials (47,764 patients) comparing former smokers and patients who had never smoked, and 20 randomized controlled trials (40,629 patients) comparing former smokers and current smokers. Outcomes considered were: necrosis, healing delay and dehiscence, surgical site infection, wound complications, hernia, and lack of fistula or bone healing. A reduction of surgical site infection incidence with smoking cessation was found in four trials, and the author concluded that there was a significantly higher rate of postoperative healing complications in smokers compared with non-smokers, and in former smokers, compared with never-smokers.

May 2012

New guidelines for diabetic foot infections; host and bacterial factors implicated in diabetic foot infections reviewed

The Infectious Diseases Society of America released clinical practice guidelines for the diagnosis and treatment of diabetic foot infections (DFI).⁷ The guidelines include a classification system for infection to determine which patients should be hospitalized, require specialized surgical interventions, or amputations. They also define types of DFI, provide guidance on antibiotic therapy, surgical interventions and imaging, and discuss wound care techniques and dressings. The guidelines were published in the June 2012 issue of *Clinical Infectious Diseases*, and are available at: <http://cid.oxfordjournals.org/content/54/12/e132.full.pdf>.

Also in the field of diabetic foot infections, Richard and colleagues⁸ reviewed diabetic foot ulcer infection and pathology. They implicated host factors such as immune defects, neuropathy and arteriopathy in infection, but also highlighted that factors relating to the infecting pathogen, such as bacterial density and virulence may be implicated in diabetic foot infection. The authors concluded that diabetic foot ulcer infections have complex pathology, resulting from a variable combination of host and bacterial factors, and discussed recent developments in molecular biology which could assist the clinician in understanding, identifying and treating diabetic foot infections.

June 2012

Enhanced susceptibility to SSI with skin infection, plus NO-np: a novel antifungal agent

Faraday and colleagues conducted a prospective cohort study⁹ to identify patient characteristics associated with an increased risk of surgical site infection (SSI). Of 613 patients undergoing cardiac, vascular, craniotomy, and spinal surgery, 22% reported a history of skin infection. Incidence of deep SSI/infectious death was 6.7% in patients with a history of skin infection versus 3.1% in those without. The authors conclude that a history of skin infection can enhance susceptibility to SSI.

Also in June 2012, Macherla and colleagues published details of a nitric oxide-releasing nanoparticle (NO-np), which was found to act as a novel antifungal agent.¹⁰ The NO-np demonstrated antifungal activity against *Candida albicans* in a murine

burn model, demonstrating effective activity against both yeast and filamentous forms. The NO-np also significantly accelerated wound healing rate in cutaneous burn infections when compared with controls, modifying leukocyte infiltration and reducing fungal activity. The authors concluded that the NO-np may have value as a novel topical antifungal agent.

July 2012

Evidence-based recommendations for chronic wound care, an increased SSI risk with malignant disease, plus a reported decrease in MRSA bacteraemia

A retrospective review by Brölmann and colleagues assessed 44 Cochrane Wounds and Peripheral Vascular Diseases Group reviews, with the aim of compiling best available evidence to support evidence-based decisions in clinical practice.¹¹ Reviews on both acute and chronic wounds were included, and 109 evidence-based conclusions were identified, on: venous and arterial ulcers, acute wounds, pressure ulcers, diabetic ulcers and miscellaneous chronic wounds. The authors identified strong conclusions on the efficacy of: therapeutic ultrasonography, mattresses, cleansing methods, closure of surgical wounds, honey, antibiotic prophylaxis, compression, lidocaine-prilocaine cream, skin grafting, antiseptics, pentoxifylline, debridement, hyperbaric oxygen therapy, granulocyte colony-stimulating factors, prostanoids and spinal cord stimulation. They concluded that these findings provide strong clinical evidence for some wound care interventions.

A retrospective study by Kadija and colleagues¹² of 538 women undergoing surgery found that malignant disease was the most important risk factor for SSI. Other significant factors related to SSI included: patient age, surgery duration greater than 120 min, postmenopausal status, diabetes mellitus, positive preoperative vaginal culture, ASA score and intraoperative blood loss.

Landrum and colleagues¹³ investigated rates of community-onset and hospital-onset *Staphylococcus aureus* bacteraemia and skin and soft tissue infections (SSTIs) in the US military health care system. The authors found a decrease in the annual incidence of community-onset MRSA bacteraemia between 2005 and 2010, with a concomitant decrease in the annual incidence rates for hospital-onset MRSA bacteraemia. They concluded that the rates of both community-onset and hospital-onset MRSA bacteraemia decreased in parallel, with a more-recent decline seen in the proportion of community-onset SSTIs caused by MRSA.

August 2012

New information on surveillance for healthcare-acquired infections, and diabetes and morbid obesity as risk factors for joint infection

A sub-committee of the UK Advisory Committee on Antimicrobial Resistance and Healthcare-Associated Infections (ARHAI) reviewed and reported on existing UK surveillance schemes.¹⁴ The main recommendations of this report were that MRSA bacteraemia and *Clostridium difficile* surveillance, and orthopaedic surgical site surveillance should be extended to include the independent sector; that surveillance of MSSA and *E. Coli* bacteraemia should be mandatory; that surveillance of Caesarean section surgical site infections and catheter-related bloodstream infections should be mandatory, but that surveillance of glycopeptide-resistant enterococci bacteraemia should be withdrawn. The authors concluded that there was a need to develop set standards for surveillance of healthcare-acquired infections in order to ensure best use of resources and to integrate the widely varying current surveillance systems.

Jämsen and colleagues analyzed the one-year incidence of periprosthetic joint infections in patients undergoing primary hip and knee replacements for osteoarthritis.¹⁵ They found that joint infection risk was more than doubled if the patient had diabetes (independent of obesity), with a trend towards higher infection rate also seen in patients with a preoperative glucose level of ≥ 6.9 mmol/L (124 mg/dL). The authors conclude that diabetes and morbid obesity increase the risk of joint infection in patients undergoing primary hip and knee replacement.

September 2012

Publication of new Cochrane reviews on pre-operative interventions for preventing infection

A new Cochrane Review analysed different pre-operative skin preparations for preventing post-caesarean infection.¹⁶ Five trials were included (1,462 women); all studied the application of skin preparations for surgery (different forms, methods and concentrations). The authors found no difference in wound or uterine infection when different antiseptic procedures were compared, and conclude that these trials provide little evidence to dictate what types of skin preparation may be most effective in preventing post-caesarean wound and surgical site infection.

Another new Cochrane Review studied the evidence for prevention of surgical site infection by preoperative bathing or showering with antiseptics in preventing hospital-acquired surgical site infections (SSIs).¹⁷ Seven studies were included, comparing washing with chlorhexidine with placebo, a bar soap or no washing. The authors found that when chlorhexidine was used for preoperative washing, no statistically significant difference in reduction of SSIs was seen, and concluded that there was no clear evidence of benefit (in terms of reduced rates of SSI) when showering or bathing with chlorhexidine, compared with other washing products.

October 2012

Successful implementation of a guideline for wound infection management, plus alcohol use related to health care-associated infections

A Leeds-based team report on the implementation of a cross-organisational clinical guideline on the management and prevention of wound infection.¹⁸ The project began with a local scoping exercise on topical antiseptic and systemic antibiotic use in Leeds, and led to the development of a cross-organisational working group to develop and implement a guideline for wound infection diagnosis, management and prevention. This included the implementation of a new tissue viability referral process for wounds where topical antiseptic treatment was required. The authors report that this guideline has led to changes in wound sampling and prescribing practices, and a reduction in the inappropriate hospital and community use of topical antiseptics.

de Wit and colleagues assessed the risk of healthcare-associated (HAI) and surgical site infections (SSI) in patients undergoing elective surgical procedures, using the Nationwide Inpatient Sample for 2007 and 2008.¹⁹ More than one million inpatient admissions were analysed, out of which 38,335 (3%) cases of HAI and 5,756 (0.5%) cases of SSI were identified. Alcohol use disorders were found to be an independent predictor of developing both HAI and SSI, and hospital length of stay was also found to be longer in patients with alcohol use disorders who developed HAI. The authors concluded that patients with alcohol use disorders had a higher risk of infectious postoperative morbidity when undergoing elective operations.

November 2012

A new review of the TIME concept, plus bacterial resistance in patients with diabetes, and reducing SSI incidence in colorectal surgery

Professor David Leaper and colleagues produced a new update and review on the TIME (Tissue, Moisture, Infection/Inflammation, Edge of wound) approach to wound bed preparation.²⁰ The authors examined new developments in wound bed preparation over the preceding 10 years, and discussed how these impact the TIME concept, and can be translated into existing best practice. They identified four particular stand-out developments: biofilms and increasing recognition of their clinical importance; the increasing use of negative pressure wound therapy (NPWT); topical antiseptic evolution both as wound dressings and lavage; improved understanding of the role that molecular biology processes play in chronic wounds. The authors conclude that the TIME principle remains relevant 10 years on, and suggest that the concept can be expanded into an increasingly holistic viewpoint to also consider how the TIME concept fits in with a holistic view of improved patient wellbeing.

Rawat and colleagues reviewed bacterial isolates from 125 patients with type 2 diabetes, testing samples for antibiotic susceptibility and resistance, as well as phenotypic testing for extended spectrum beta-lactamase (ES β L), AmpC, and metallo-beta-lactamase (M β L) enzymes, and for high-level aminoglycoside resistance (HLAR) in *Enterococcus* spp.²¹ A total of 38 patients (30.4%) had bacterial infections, of which 18 of 35 (51.4%) had wound infections. The predominant gram-negative pathogen was *Escherichia coli* and the predominant gram-positive pathogen was *Staphylococcus aureus*. Resistance to methicillin and to macrolide-lincosamide-streptogramin was found in 50% and 33.3% of *Staphylococcus* spp. isolates, respectively, and HLAR resistance was found in 60% of *Enterococcus* spp. The authors concluded that antibiotic resistant bacterial infections are common in patients with diabetes.

Surgical teams at Cedars-Sinai Hospital, Los Angeles, US reported on the introduction of evidence-based protocols for reducing surgical site infection (SSI) as part of a national research project to develop protocols to reduce SSIs in patients undergoing colorectal surgery.²² New infection-preventing steps based on modified or optimized past practices included: showering with chlorhexidine solution by patients before surgery and use of chlorhexidine wipes for patient bathing post-surgery, use of a sterile chlorhexidine and alcohol solution to prepare operative sites prior to surgery, standardization of pre-operative antibiotics, use of wound protectors when handling intestines, a change of gowns, gloves, surgical covers and instruments by surgical staff following completion of the contaminated portion of colorectal procedures, and daily wound probing in wounds considered to be at high risk for infection. After introduction of these protocols, the rate of post-operative surgical site infections following colorectal surgery decreased to less than 5% within 6 months from a baseline of 15%.

A retrospective study by Cannon and colleagues also investigated practices for reducing SSIs following colorectal surgery.²³ The authors examined the relationship between SSI and mechanical bowel preparation and oral antibiotics, using linked Veterans Affairs Surgical Quality Improvement Program data on preoperative risk and SSI outcomes, with Veterans Affairs Surgical Care Improvement Project and Pharmacy Benefits Management data. Significantly lower SSI rates were seen in patients receiving oral antibiotics prior to surgery, and the use of oral antibiotics plus mechanical bowel preparation was associated with a 57% decrease in SSI occurrence, while use of oral antibiotics alone was associated with a 67% decrease in SSI occurrence. The authors also found lower SSI rates in hospitals with higher

use of oral antibiotics, concluding that these results support the administration of pre-operative oral antibiotics to prevent SSI in patients undergoing elective colorectal resections.

December 2012

A novel method for early detection of infection, plus improved pressure ulcer closure rates with collagenase dressings

Milne and colleagues compared collagenase and hydrogel dressings for maintenance debridement and wound closure in institutionalized adults with pressure ulcers.²⁴ Only those patients who successfully completed phase 1 of the study (complete debridement of all visible, nonviable tissue by day 42) were included in phase 2. When phase 1 and phase 2 study data were collated, a statistically significant difference in pressure ulcer closure rates at study end was seen between the two groups, with closure rates of 69% in the collagenase group and 21% in the hydrogel group ($P=0.0213$). Weekly reductions in wound size also occurred at a greater rate in the collagenase group than in the hydrogel group. The authors conclude that this study showed statistical significance in favour of collagenase over hydrogel when evaluating pressure ulcer closure rates.

Douraiswami and colleagues correlated C-reactive protein (CRP) and interleukin-6 (IL-6) levels with infection levels in 30 patients with open fractures of the upper or lower extremity.²⁵ Serum CRP and IL-6 concentrations were measured both preoperatively and postoperatively, and levels were compared in infected and non-infected patients. Postoperative CRP levels decreased in patients without infection but were persistently elevated in patients with infection; postoperative IL-6 levels were elevated in patients with infection at day 2 following surgery, but decreased by day 4. The authors found a correlation between increased serum CRP and IL-6 concentrations and wound infection, and concluded that serial serum measurements of CRP and IL-6 can facilitate the early diagnosis of infection in open fractures, before it is clinically evident.

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This 2012 retrospective reviews interesting articles published in the field of wound infection in 2012. Articles include:

The new update and review on the TIME (Tissue, Moisture, Infection/Inflammation, Edge of wound) approach to wound bed preparation produced by Professor David Leaper and colleagues.

Findings by Maddocks and colleagues at Cardiff Metropolitan University that manuka honey demonstrates bactericidal effects against *Streptococcus pyogenes* cultures, including biofilms.

Updated and new Cochrane reviews on the efficacy of water as a wound cleansing agent, antibiotic prophylaxis for postoperative wound infection, and pre-operative interventions for preventing infection - plus a review of 44 Cochrane Wounds and Peripheral Vascular Diseases Group reviews.

Clinical practice guidelines for the diagnosis and treatment of diabetic foot infections, released by the Infectious Diseases Society of America.