VWHA Proceedings June 7th 2019

WOUND INFECTIONS AND ANTIMICROBIAL USE IN VETERINARY WOUND MANAGEMENT

Venue: Swedish Exhibition & Congress Centre, Gothenburg

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Welcome !

Welcome to the beautiful city of Götenborg, and to the International Conference of the Veterinary Wound Healing Association, organised in collaboration with the EWMA. Our theme for today is:

"Wound infections and antimicrobial use in veterinary wound management"

This theme is very important both for human and veterinary wounds, as the threat of bacteria and more importantly resistant bacteria is always present. We will focus on wound bacteria, the who is who of wound infections, how to recognize wound infection in veterinary patients, when does the patient needs antibiotics and when can or should its use be avoided. Additionally we will focus on how we can control the influence of bacteria with alternative antimicrobial strategies.

Promoting proper wound management is a never ending challenge. The VWHA takes up this challenge although it is sometimes very hard! If we wouldn't do, who else is going to do this task? The problem is that traumatic wounds are every day patients in most veterinary practices, and the general thought is that everything is already known and that the right thing is done. That attitude makes is so hard to make colleagues aware that there can be improved a lot, certainly when talking about the use of antibiotics. Although we think we know already everything about wounds, it appears that both human and veterinary colleagues do not always recognize that treatments and choices can be optimized. For example: in human medicine 50% of the antibiotic courses are unnecessary or inappropriate, and this will certainly not be different in veterinary medicine. A survey about the decisions of vets about antibiotics when a patient with a traumatic wound is admitted, reveals some misunderstandings. For such reason, the VWHA keeps on pushing and pulling to change minds and create awareness towards improvement and development like EWMA does for the human field!

The VWHA is very grateful that EWMA has given us the opportunity to be here as part of their programme. This is a big chance for both the veterinary and human professionals to get the opportunity to learn from each other. Not only the veterinary profession can enjoy the extensive EWMA programme, but the human profession is welcome to join our programme and to taste a wide experience and creativity in veterinary science and practice. There are a lot of similarities between the human and veterinary wounds, but also many differences and this mixture can create new ideas.

The VWHA also likes to thank our sponsors of today and our general sponsors. As a charity, we could not even exist without commercial sponsors, leave alone that we could organise a conference or practical courses. Therefore we are very grateful for the support of the sponsors for this International Conference 2019 which are presented on the left page.

The VWHA also likes to thank the speakers: without speakers we wouldn't have a programme. It is very good that we can all share our knowledge and in this way can improve our treatment strategies and research goals. It is a lot of work to prepare a Conference such as this and hopefully we manage to inspire the audience for the future of wound management after today.

We hope that you will all feel and experience with us that the VWHA is a worthwhile and inspiring association. We are dedicated to further improve veterinary wound care and thus the welfare of animals in our care in particular. Spread the word about the VWHA, and if you are not a member yet please just become one, because more members means more contacts and more contacts means more ideas, more inspiration, more improvements and more solutions! And not to forget: more FUN!

Have a nice day!

Jacintha M. Wilmink,
President of the Veterinary Wound Healing Association

VWHA

The Veterinary Wound Healing Association (VWHA, www.vwha.net) is a non-profit organisation focusing on the improvement of management of wounds in animals. The VWHA aims to do this by:

- Promotion of education and research into the scientific basis and the clinical management of wounds of whatever aetiology in the veterinary sciences.
- Establishing training courses together with national and international conferences to discuss and promote aspects of wound healing research and wound management.

The VWHA was established in 1996 and has been, from the beginning, a charity (registered by the Charity Commission of England and Wales, Number 1090458). The VWHA brings together clinicians, and scientists from veterinary and human medicine with a special interest in wounds. We aim to increase knowledge and to share clinical experience for the progression of wound management and for the benefit of patients.

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- Access to proceedings of former scientific conferences
- Access to pdf's of the majority of presentations held during the last scientific conference (this year the pdf's will be placed shortly after May 4th 2017)
- Voting privileges in matters associated with the VWHA
- Use of the council members to seek advice on management of your own patients

Membership of the VWHA is only 40 euros per year!

Just go to: www.vwha.net

"WOUND INFECTIONS AND ANTIMICROBIAL USE IN VETERINARY WOUND MANAGEMENT"

Friday, June 7th 2019: 8.30 – 16.00

PROGRAM

8.30 – 8.40	Opening through VWHA President	Jacintha Wilmink
8.40 – 12.40:	**Session 1: Infection and antimicrobials**	
8.40 – 9.00	The bad and the ugly - the who is who of wound infections	Mirja Nolff
9.00 – 9.20	Biofilms – detection and effect on wound healing	Elin Jørgensen
9.20 – 9.40	Clinically recognizing wound infection	Jacintha Wilmink
9.40 – 10.00	Sampling techniques and news in bacterial swabbing	Elin Jørgensen
10.00 – 10.20	Culture results-targeting treatment avoiding pitfalls	Mirja Nollf
10.20 – 10.50	**Coffee break**	
10.50 – 11.20	Non-antibiotic surgery	Henriette Strøm
11.20 – 11.40	What do we, vets, decide about antibiotics when a traumatic wound is admitted; Results of a survey	Jacintha Wilmink
11.40 – 12.00	Antibiotic treatment under the light of resistance in veterinary open wounds	Mirja Nollf
12.00 – 12.20	Locally applied bioburden control	Jacintha Wilmink
12.20 – 12.40	Panel discussion on antimicrobial use in veterinary wound management	All
12.40 – 13.30	**Lunch**	
13.30 – 15.30	**Session 2: Case workups**	
13.30 – 14.20	Small animal wound cases	Mirja Nolff
14.20 – 14.40	**Coffee break**	
14.40 – 15.30	Equine wound cases	Jacintha Wilmink
15.40 – 16.00	**AGM VWHA – please join – Everybody is invited**	

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THE BAD AND THE UGLY-THE WHO IS WHO OF SURGICAL SITE INFECTIONS

M.C. Nolff

Small Animal Surgery, Tierspital, Vetsuisse University Zürich, Switzerland

Studies evaluating the prevalence of certain bacteria in surgical site infections (SSI) in small animal surgery have repeatedly documented the overexpression of the so called ESKAPE group of bacteria (*Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa , and Enterobacter species*) in these patients. ESKAPE pathogens represent the most frequent isolates cultured in nosocomial infections in humans and have been classed as high risk pathogens. The fact that they are so problematic arises from their ability to form biofilm and rapidly develop resistance.

Staphylococci represent one major source of SSI in small animals. They are normally introduced to the wounds from the oral flora or via skin contamination. However, while human patients and horses are mainly affected by *Staphylococcus aureus*, the main isolate in dogs is *Staphylococcus pseudintermedius*. The most frequent *Staphylococcus pseudintermedius* clone found in Europe is ST71, a very strong biofilm former with capacity for horizontal gene transfer. Resistance does not increase the virulence of the bacterium, and Staphylococci are susceptible to antiseptics like octenidine and polyhexanid.

The next group of bacteria, the *Enterobacteriacae* represent a group of faecal contaminants frequently encountered in SSI. As Staphylococci, they are strong biofilm formers, human pathogenic isolates are frequently encountered and they are frequently resistant to fluochinolones. An especially concerning development is the increasing rate of isolates with Extended Spectrum Beta Lactamase resistance (ESBL) documented in dogs. ESBL is encoded in the AmpC gene, which can be transferred between bacteria species via horizontal gene transfer. Usage of 3rd and 4th generation cephalosporins will trigger ESBL resistance, however a study in dogs has also documented that usage of cephalexin selects for CMY-2 producing *E. coli* isolates – encoding extended spectrum cephalosporin resistance. Among the ESBL, E. coli isolates indistinguishable from human isolates have been frequently encountered in dogs and cats, suggesting transmission from and to owners. Although the impact of this is not clear, this poses a significant risk.

Enterococcus spp. (especially *Enterococcus faecium* and *faecalis*) have been classed as the

3rd most dangerous nosocomial bacteria worldwide. Interestingly, veterinary textbooks of surgery currently state that *'Enterococci are infrequently the cause of infection'*. Based on the current literature and our own experiences this cannot be supported. As with the other members of ESKAPE, human pathogenic genotypes have been found in dogs, and horizontal gene transfer is possible. One fact that has to be mentioned is the vast variety of intrinsic resistance present in these bacteria, including all beta lactam drugs- that will not necessarily be displayed in a routine culture.

Pseudomonas aeruginosa represents the number one wound pathogen isolated in dogs and cats. This originally environmental bacterium is facultative pathogenic and extremely tolerant to various environmental impacts. It displays a wide range of antibiotic resistance, including resistance to a number of antiseptics including polyhexanid. It is susceptible to 1% acetic acid lavage and some types of bee defensins. Pandrug resistance has been described and can be triggered by using combination antibiotic therapy. As *Pseudomonas*, *Acinetobacter baumanii* is facultative pathogenic and highly tolerant to all type of environmental impacts. Although the incidence of infections among small animal patients is low, the mortality in these infections is high (60%). *Acinetobacter* is capable of de-novo resistance formation and the correlation between culture results and in vivo susceptibility is unknown.

BIOFILMS – DETECTION AND EFFECT ON WOUND HEALING

E. Jørgensen

Department of Veterinary Clinical Sciences, University of Copenhagen

In humans, biofilms are present in most chronic wounds according to recent expert consensus guidelines, and the prevalence has recently been estimated to 78 % in a large meta-analysis. Further, biofilms have long been known as a cause of chronic wound infections in humans including diabetic foot ulcers, pressure ulcer and venous leg ulcers. In veterinary medicine, biofilm formation in wounds has been studied to a very limited degree, it would though be naïve to think that bacteria behave markedly different just because the host is a dog or horse compared to a human being. Biofilms have been detected in equine surgical and traumatic wounds, and in a recent study biofilms were linked to impaired wound healing in equine limb wounds. Furthermore, biofilms have been identified in canine wounds.

Biofilm is the default mode of bacterial living; the opposite is planktonic or single cells as known from culture plates and shake cultures in the laboratory. Biofilms are aggregates of bacteria embedded in a matrix, and by definition, bacteria in biofilms are more tolerant of antibiotics and host defenses than planktonic bacteria, which makes treatment of these wound infections very difficult, however the best therapy is always to remove the biofilm, so if possible debridement is always the best initial treatment.

Besides residing in wounds, biofilms are known from human medicine to cause a wide array of chronic infections. Further, biofilms are fond of attaching to surfaces, and thereby are all artificial surfaces (implants, catheters, sutures, plates etc.) that we introduce into an animal, at risk of biofilm infections. In patients with prosthesis or implants, it is often very difficult to differentiate an aseptic loosening from a delayed-onset low-grade infection cause by biofilm, especially because the infection can develop months to years after the surgery. Again, the best treatment is to remove the implant/catheter/plate and follow up with antimicrobial/anti-biofilm treatment.

Biofilms continuously attract leukocytes to the wound, thereby causing chronic wound inflammation, as the leukocytes are seldom able to eradicate the biofilms. The leukocytes' capability of phagocytosis and their oxidative burst are impeded by biofilms. Further, biofilm infections in chronic wounds cause low oxygen tension, as the biofilm itself consumes oxygen

as do the attracted leukocytes. This causes a vicious circle where hypoxia and chronic inflammation favor further biofilm formation and often also result in collateral damage to the tissues caused by the immune response itself.

Diagnosing biofilm infections in wounds is difficult. First of all, biofilms are heterogeneously distributed within the wound, making representative sampling challenging. Secondly, the bacteria within a biofilm are often at a low metabolic state and might not be detected by normal culture. Thirdly, the gold standard for diagnosing biofilm is direct visualization of the biofilm within the tissue, which require that a biopsy is obtained from the wound. Visualization is preferable by using peptide nucleic acid fluorescence in situ hybridization and confocal scanning laser microscopy and/or scanning electron microscopy. These methods are time-consuming, expensive, and not routinely available in wound diagnostic, to neither human nor veterinary patients. At a recent consensus statement from 2017 experts agreed that, “there are currently no routine diagnostic tests available to confirm biofilm presence in wounds”. Therefore, until better diagnostic tests are developed, biofilm infection should be suspected and treatment initiated in wounds, which despite correct and adequate treatment do not heal in a timely manner.

CLINICALLY RECOGNIZING WOUND INFECTION

J. Wilmink

Woumarec, Wageningen, The Netherlands

Introduction: Wounds always harbor bacteria. Infection is not a matter of an on or off switch, but it is a flexible scale from contamination, to colonization, critical colonization and finally infection. Dependent on the number of bacteria, more or less or no clinical symptoms will be present.

Wound groups: Wounds can be divided in three groups: open (chronic) wounds that heal by second intention, acute or subacute wounds that are not sutured, and wounds that are sutured. Infection of sutured wounds will result in wound dehiscence and will therefore be easy to recognize. Clinically recognizing wound infection in wounds healing by second intention can be hard.

Infection of open wounds: can result in systemic symptoms (fever, chills, elevated inflammatory mediators), primary symptoms (classic signs of rubor, calor, tumor and dolor: so symptoms in the environment of the wound), and secondary symptoms (friable or discoloured granulation tissue, pocketing, undermining of the wound margin, foul odour, or just delayed healing).

Treatment of infected open wounds: systemic antibiotics do not result in decontamination of open wounds, which is due to poor circulation and poor delivery in wound locations where bacteria hide (debris, necrosis, fibrin deposits, exudate and biofilm), whereas there is a significant chance on the development of resistant bacteria due to the use of antibiotics. This means that antibiotics make no sense in patients with wounds with just local wound problems, so the secondary symptoms. These wound can more effectively be treated with antimicrobials not based on antibiotics. Antibiotics are only indicated in patients with systemic symptoms and with primary symptoms, so these are patients with additional problems beyond the wound. Antibiotics should be stopped once infection is under control

Conclusion: Open wounds always harbour bacteria, but these do not always have to be killed. Systemic antibiotics are only indicated when bacteria cause systemic or primary symptoms, and not when just secondary symptoms are present. Consequentially, the use of antibiotics during treatment of open wounds can be, or should be, reduced to almost zero.

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SAMPLING TECHNIQUES AND NEWS IN BACTERIAL SWABBING

E. Jørgensen

Department of Veterinary Clinical Sciences, University of Copenhagen

To be, or not to be infected, that is the question. All wounds contain bacteria, so a sample from a wound will always display bacteria. Whether the presence of bacteria is critical for the host/wound healing depends on whether the bacteria are present as contamination, colonization, critical colonization or wound infection. The "old" 10^5 bacterial growth guideline dictates that more than 100,000 viable bacteria (CFU) per gram tissue is to be considered a wound infection. However, this cut-off has been challenged in recent years, as it seems more important how the host reacts to and deal with the bacteria and how the bacteria are organized (virulence factors, biofilm formation, pathogenic potential etc.). So wound infection is mainly a clinical diagnosis that can be supported and further investigated by bacterial culture. Clinically it can be very difficult and challenging to make the diagnosis wound infection, as many chronic wounds show very subtle clinical sign; this is however not within the scope of this talk.

A sample should be collected for culture based on clinical suspicion of a wound infection. Culture of biopsies are considered the gold standard, however, as they are invasive many are reluctant to obtain biopsies. Both in human and veterinary medicine some studies have found that culture of swabs can elucidate sufficient information compared to biopsies under some instances. When taking a swab from a wound, the Levine technique is the recommended method. The Levine technique consists of rotating the swab over a 1 cm^2 area of the wound applying sufficient pressure to release wound fluid from the deeper part of the wound. Apparently, this applied pressure and thereby extracted wound fluid accounts for the better yield and detection in this swabbing technique compared to others. There is also debate whether the wound should be cleansed before sampling or not. Most do, however, agree on removing the surface contamination, as the bacteria residing at the wound surface seldom are the ones involved in the impaired healing. In case of necrotic tissue it is recommended to debride the wound before sampling. It is further recommended to avoid cotton-tipped swabs, a useful alternative is the flocked tip swabs (eSwab®), that also elutes the sample into the medium (liquid Amies) making several test aliquots available from the same sample.

Regardless of the sampling method, a great challenge when assessing wound bioburden is the fact that bacteria within wounds are unevenly distributed, thereby a biopsy or a swab might not be representative of the wound, and thus not necessarily useful or even misleading in diagnosing wound infections and directing treatment. Further, bacteria residing as biofilm might not be cultureable due to low metabolic activity.

After prober culture, the clinician should preferably receive both a (semi-)quantification and an identification of the different bacteria in the wound as well as the bacterias resistance patterns. Most wound samples contain 2-6 different strains on culture.

Take home messages: Wound infection is a clinical diagnosis that can be supported and elucidated by bacterial culture preferable of a tissue biopsy otherwise of a swab obtained using the Levine technique. It is recommended to always obtain bacterial identification and (semi-)quantification besides resistance patterns. The clinician should be aware of the pitfalls involved in sampling and culturing wound samples.

CULTURE RESULTS-TARGETING TREATMENT AVOIDING PITFALLS

M.C. Nolff

Small Animal Surgery, Tierspital, Vetsuisse University Zürich, Switzerland

The spread of multidrug resistant bacteria represents one of the most important threads in modern medicine. Numerous authors reported rising numbers of resistant bacteria isolates among small animal populations, including rising numbers of Extended Spectrum Beta Lactamase (ESBL) resistant *Enterobacteriaceae*, pandrug resistant *Acinetobacter baumanii* and *Pseudomonas aeruginosa* isolates as well as increasing numbers of high risk *Enterococcus* spp. clones. Numerous surveillance programs and campaigns have addressed this problem.

The micribiological laboratory will define a bacterium as susceptible, intermediate or resistance based on breakpoints for this bacterium in the given species. Traditionally these have been determined based on the expert opinion of a counsel of scientists and economy representatives by the Clinical and Laboratory Standards institute in the CLSI VET01 document. Unfortunately, there are very few known breakpoints available in dogs and cats, and some very important antibiotics do not even have any breakpoints given in this document (for example cefovecin). For all instances, were there is no breakpoint available, the lab will have to analogy of other species or known human breakpoints. So while we anticipate that our test gives us the exact information for the bacteria we just found in our patient, most of the time this will rather be an educated guess than exact facts. So whenever you read your test, the first thing you have to be aware of is that what you might have in your hands might not 100% reflect the situation in your animal.

The next important fact in this scenario is that it does not help to know a breakpoint, if we actually do not know what concentration we can achieve in our patient. So when you chose your antibiotic you have to be aware of the pharmacokinetic of this substance. Even if the bacterium is in theory susceptible to the substance, will you be able to reach the needed Cmax of the drug in your tissue? And unfortunately, for a lot of drugs and tissues we do not now this.

Luckily, there is also something about in vitro testing that counts in our favour- in general you can apply the 90-60 rule. You will be able to efficiently treat 90% of susceptible bugs, while resistant bacteria will only respond in 60% of cases. This is true because the test you read

does not mimic the biological environment that is present in your patient- especially it does not include the effect of the immune system. So even if you get a resistant result, you might still be able to get some clinical effect with the chosen drug. Having said this, the effect of your therapy will likely be overestimated in all types of tissues that cannot be reached easily (necrosis or fluid accumulations- if there is no blood flow, there is no antibiotic delivery, organs with a blood – tissue barrier such as CSF or prostate).

Finally, you have to consider bacteria associated factors: Bacteria might adjust to your treatment or have intrinsic resistance to a variety of substances. ***This will not necessarily be marked in your results, as laboratories take it as common knowledge.***

Finally, there is the **most important fact**: consider the need for therapy! Just because we cultured something horrible, doesn't mean we have to treat it- or that we can.

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NON-ANTIBIOTIC SURGERY

H. Strøm

Evidensia Lund Djursjukhus, Sweden

This talk will be on how and when antibiotics should be used and especially not used in veterinary surgery, and what measures that can be done to lower the use (and need) of antibiotics.

WHAT DO WE, VETS, DECIDE ABOUT ANTIBIOTICS WHEN A TRAUMATIC WOUND IS ADMITTED; RESULTS OF A SURVEY

J. Wilmink

Woumarec, Wageningen, The Netherlands

Introduction: When patients with a traumatic wound are admitted, we like to prevent the development of wound infection as this can damage the tissues involved and impair healing. There are not many scientific data on which we can base our decisions about use of antibiotics for patients with traumatic wounds. Our decisions are often based on the duration of the wound, contamination, location, depth and structures involved. But do we make the right decision? Can antibiotics have the effect we suppose? How often is our decision based on fear? To get more insight in what is decided in practice, a survey has been performed under both equine and small animal practitioners.

Infection continuum: Wounds caused by trauma are always contaminated, usually with mixed bacterial flora of Gram positive and negative bacteria. The older the wound, the higher chance that bacteria have had the opportunity to colonize, multiply and finally cause an infection. Roughly we can assume that up to 6 hours after the accident, bacteria are just present and they try to adapt to the wound. Between 6 and 8 hours, adaptation succeeded and bacteria form colonies. Around 12 hours the number of bacteria surpasses the local defense of the host and bacteria start to invade the tissues. Between 12-24 hours we can suppose that infection can have developed.

Result of the surveys: show that equine and small animal vets reacted similarly on the questionair. Here, the results of the equine survey are presented. Two-third of the vets decided to start systemic antibiotics in case of an (sub) acute wound. The length of time depended on the duration of the wound: the older at presentation, the longer time antibiotics were given, up to 5-7 days for wounds older than 6 hours that were sutured. Interestingly, antibiotics were given for a longer period when wounds were not sutured up to 5-14 days, with more variation. The length of time also depended on the degree of contamination: the more contamination, the longer time antibiotics were given, up to 7 days in severely contaminated wounds that were sutured and even longer when not sutured. The length of time also depended on the structures involved and increased when abdomen, thorax, synovial structures, flexor tendons, extensor tendons and bone were involved.

Conclusion: Veterinarians not always follow the right rational in their choice to give antibiotics to an animal with a traumatic wound, because of the lack of scientific data on this subject and the fear for complications. When the awareness of certain factors would improve, a significant reduction in the use of antibiotics can be achieved.

Systemic antibiotics are indicated mainly for patients with traumatic wounds that are sutured, as bacteria in these wounds are not accessible anymore in other ways. In those cases, antibiotics should be started asap and preferably intravenously. Systemic antibiotics can largely be avoided when wounds are not sutured, as bacteria in these wounds are accessible by topically antimicrobial dressings or agents. The period of time that antibiotics are given should therefore mainly depend on treatment (closure or not) as well as wound factors such as duration of the wound and structures involved, but not on the degree of contamination because contamination has to be solved by debridement. Debridement cannot and should not be replaced by using antibiotics. The period of time is likely to increase when life threatening structures such as abdomen, thorax, synovial structures and flexor tendons are involved, but the increase in time is not necessary for structures such as ruptured extensor tendons and cortical bone where debridement is more effective.

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ANTIBIOTIC TREATMENT UNDER THE LIGHT OF RESISTANCE IN VETERINARY OPEN WOUNDS

M.C. Nolff

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The spread of multidrug resistant bacteria represents one of the most important threads in modern medicine. Numerous authors reported rising numbers of resistant bacteria isolates among small animal populations, including rising numbers of Extended Spectrum Beta Lactamase (ESBL) resistant *Enterobacteriaceae*, pan-drug resistant *Acinetobacter baumanii* and *Pseudomonas aeruginosa* isolates as well as increasing numbers of high risk *Enterococcus* spp. clones. Unfortunately, the past years have shown that the ESKAPE group of bacteria (*Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa , and Enterobacter species*), which has been classified as the group of most important nosocomial bacteria with a vast resistance potential is on the rise in our wound patients as well.

Numerous studies have been conducted in dogs and cats, and have routinely identified the following factors as being risk factors for development of resistant bacteria: being fed a raw meat diet, being hospitalized, receiving antibiotic therapy, and even more receiving combination antibiotic therapy. Finally we recently documented a worryingly development in our bite wound trauma cases as well. While we were able to prove that patients admitted with bite wounds between 2013 -2015 were only affected by MDR in 6% of cases (antibiotic pre-treatment was significantly associated with occurrence of resistance), this number has risen to 45% in patients evaluated between 2015 and 2018. This is an alarming trend, which nicely emphasizes the rising problem of multidrug resistance in our patients. Fortunately, this rise did not translate to a rise in complication rate of post-surgical infections.

These data underline the need for prudent antibiotic usage in our patient. By reducing the amount of prescribed antibiotics, we can effectively decrease the selection pressure and therefore the likeliness of MDR occurrence.

Open wounds show bacterial contamination in in up to 89%, with close to 50% of bacteria being MDR. Despite targeted treatment, these wounds are only rarely truly decontaminated, and current recommendations in human medicine do not include antibiotic treatment in open wound treatment per se anymore- even if bacteria are present in the wounds. It is rather

accepted, that a full decontamination is not possible, Antibiotic- or antiseptic treatment is only warranted in cases with local and / or systemic infection.

If systemic infections developed the difference between a resistant isolate and a susceptible clone becomes paramount, since the role of antibiotics in treating these systemic infections is way higher than in local infection management, were debridement, lavage and open therapy might be enough to do the trick.

Modern approaches of open wound care, such as negative pressure wound therapy, can effectively help to manage infection and modern strategies for wound care avoiding antibiotics should be applied whenever possible.

LOCALLY APPLIED BIOBURDEN CONTROL

J. Wilmink

Woumarec, Wageningen, The Netherlands

Introduction: The use of antibiotics during treatment of open wounds should be avoided, both systemically and topically. What are the alternatives to treat bacteria that cause problems in open wounds?

Other factors that influence the bacterial load in open wounds: are self-evident but sometimes overseen. The surroundings of the wounds should be clipped/shaved, washed and disinfected to reduce the bacterial load around the wound. The number of bacteria in the open wound is reduced mechanically by flushing the wound under pressure, cleaning it with swabs moistened with saline, and by surgical debridement. Removal of exudate is optimized by the negative pressure created during NPWT. Additionally, the number of bacteria in the wound is influenced by the local wound climate provided by the bandage, of which the primary contact layer or dressing in particular is of paramount importance. The contact layer should provide good absorption of exudate including bacteria (for example by using alginates or foams), whereas occlusion must be prevented because this promotes bacterial growth (no hydrocolloids, fatty topical products, wet gauzes or wet cotton padding). In case of an irregular surface, gel-like products (hydrogel, honey) or gelating products (alginates) make a better contact with the tissue than solid dressings. Overgrowth of certain bacterial species can be prevented by avoiding the use of antibiotics and the inflammatory response should not be opposed.

Control of bioburden of open wounds: can be achieved in the first place by using dressings and topical products based on antiseptics (PHMB/polyhexanide, Octenidine, hypochlorous acid) on metals (silver, copper), active absorption (special fibers like Sorbact, activated charcoal, hypertonic saline or sugar), honey products and probiotics. These agents control bioburden by inhibiting bacteria (antiseptics, metals, honey), by binding bacteria (special fibers and activated charcoal) by dehydrating bacteria (hypertonic saline and sugar) and by competition (probiotics). The use of disinfectants (chlorhexidine, povidone iodine, hydrogen peroxide) in open wounds should be avoided because these are in general too toxic for wound fibroblasts and leucocytes. Less common are the use of topical gasses (oxygen and ozone) and physical methods (electric current, pulsed radiofrequency, electromagnetic fields, magnets, shockwave, low level laser, high power laser and ultrasound). The available evidence to support the use of these modalities is so far rather limited.

An open wound with secondary symptoms may sometimes react better on one type of dressing than the other. This can be caused by the bioburden and the sensitivity for the active antibacterial agent, but it can also depend on the wound climate that is provided by the dressing. Switching between active agents and type of dressing can be very effective.

Conclusion: Many antimicrobial products and modalities are available that can reduce the number of bacteria in open wounds and their influence on healing. The effect not only depends on the type of antimicrobial agent but also on the formulation in which it is applied. Other factors that influence the bacterial load in open wounds such as local hygiene, mechanical removal of bacteria, absorption and occlusion are important to consider.

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