The Role of SILVERCEL® in Veterinary Wound Management
Written by Georgie Hollis BSc

Silver has a beneficial antimicrobial effect that has been recognised for many hundreds of years, from as far back as Roman times where silver vessels carried by soldiers kept their water free from waterborne disease, to the early 19th century where silver was used as a suture material and in a solution of silver nitrate for eye infections and in the treatment of gonorrhoea.

In the 1930s the age of modern medicine began to discover new ways to treat infection and with the development of antibiotics silver’s use fell from favour. Its value as a precious metal made it a comparatively expensive choice and a great deal more labourious to use than a simple ‘cure all’ tablet. The antibiotic became the favourite of the general practitioner who was probably relieved that he could ignore the festering wound and deal with infection systemically. Unfortunately this approach was unlikely to address the local contributors to wound infection (table 1) and certainly selected for resistance due to what was likely to be poor perfusion of antibiotics to the site of the wound and the resultant need for repeated doses.

In terms of how this works in the wound environment, it may be best to illustrate using a forgotten piece of silver jewellery. The black tarnish, which is actually silver oxide (Ag₂O) will enable the silver to be released once in a solution. A saline environment like the wound will mean a silver solution in its ionic form with 47 protons (+) and 47 negative electrons (-) state. That means it has to be converted from its stable and balanced elemental form of 47 positive protons (+) and 47 negative electrons (-) to its ionic form with 47 protons and 46 electrons. The loss of electrons gives a small positive charge illustrated by Ag⁺ and is termed ionisation.

Ionisation can be achieved when silver is made available in a compound that will react with oxygen or dissolve in water, although the larger the piece of silver, the lower the surface area that is available for reaction. As a result many dressings use particulate silver or nanoparticles that achieve a large area for ionisation in a relatively low volume.

Within only two decades after we developed antibiotics commercially we had selected resistance in the form of meticillin resistant staphylococcus aureas (MRSA). The first ‘superbugs’ were born.

In veterinary practice dirty and traumatised wounds are plentiful and will certainly benefit from the strategic use of a silver dressing during early management. As a guide the level of contamination in the wound and cause of injury will indicate the risk of development of infection. Well recognised as a driver for bacterial resistance the increased global need for food and animal production has meant since their early development antibiotics have been used as a food additive to reduce the incidence of disease, boost production and increase profitability. On a commercial level it is an exceptionally difficult argument but one which is limiting our antibiotic armoury as resistance develops.

Table 1. Causes of wound infection: Reliance on antibiotics is no substitute for practical wound management

<table>
<thead>
<tr>
<th>Causes of infection:</th>
<th>is the contributing factor addressed by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Necrotic Tissue</td>
<td>Physical debridement and topical antimicrobial</td>
</tr>
<tr>
<td>Postransplanted tissue</td>
<td>Systemic or topical antibiotics</td>
</tr>
<tr>
<td>Foreign Body</td>
<td>Y</td>
</tr>
<tr>
<td>Systemic infection</td>
<td>N</td>
</tr>
<tr>
<td>Poor perfusion</td>
<td>N</td>
</tr>
<tr>
<td>Heavy contamination</td>
<td>Y</td>
</tr>
</tbody>
</table>

Assumes target bacteria are sensitive to the selected antibiotic and the correct dose and duration of action is achieved.

Silver as an antimicrobial
A search for a reliable and safe alternative to antibiotics meant scientists began to revisit silver and its historical antimicrobial claims. They found that silver, in various forms and compounds, could be used as an effective topical antimicrobial against over 150 different pathogens which most problematic strains of bacteria, yeasts and fungi including MRSA. Despite millions of years of exposure to microbes resistance to elemental silver was clearly rare and meant it had massive potential as a topical alternative to antibiotics.

How silver works:
Silver is represented in science and medicine using its elemental symbol Ag. To be useful as an antimicrobial silver needs to be in its ionic state. That means it has to be converted from its stable and balanced form.

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Table 2. Management of contamination and indications for SILVERCEL® Non-adherent dressings

<table>
<thead>
<tr>
<th>Status</th>
<th>Typical wound</th>
<th>Local Management options</th>
<th>Indications for SILVERCEL® Non-adherent dressings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean wounds</td>
<td></td>
<td></td>
<td>Not required unless wound needs a barrier to contamination: a. for wounds at high risk post surgery, eg. Post Arthroscopy b. in clinics where cross contamination from other known MRSA patients is a potential risk.</td>
</tr>
<tr>
<td>Clean contaminated wounds</td>
<td>Low</td>
<td>Direct closure possible if wound less than six hours old.</td>
<td>SILVERCEL® can be used post debridement to reduce bacterial load over the wound bed while preventing further colonisation.</td>
</tr>
<tr>
<td>Dirty Wounds that have been thoroughly lavaged and debried using aseptic techniques</td>
<td>Low</td>
<td>Direct closure possible if wound less than six hours old.</td>
<td>SILVERCEL® can be used post debridement to reduce bacterial load over the wound bed while preventing further colonisation. The calcium alginate component of SILVERCEL® will also have a positive effect stimulating healthy granulation tissue formation following debridement and can also be used to encourage granulation over exposed bone. Pre-moisten with saline if using over exposed bone and tendons if exudate levels are too high to prevent from drying.</td>
</tr>
<tr>
<td>Contaminated Dirty Wounds containing clean, dirty or infected wounds</td>
<td>High</td>
<td>Thorough and repeated lavage and debridement necessary to remove devitalised tissue, and foreign material and slough. As above a period of open wound management is to be expected in order to gain a healthy granulation bed for closure by primary or second intention.</td>
<td>SILVERCEL® can be used as a primary dressing until a healthy wound bed is achieved.</td>
</tr>
</tbody>
</table>

To be useful in the wound environment silver needs to be combined with a dressing that is conformable to the wound bed (to reduce dead space and pockets where microbes can flourish), allows steady and consistent antimicrobial action, and can maintain a healthy wound environment for optimal healing. Furthermore, the dressing should be gentle enough not to cause trauma on removal (table 3).

Table 3. Ideals of a Silver Dressing

<table>
<thead>
<tr>
<th>ActionCure®: Smith and Nephew</th>
<th>Flamazine®: Smith and Nephew</th>
<th>SILVERCEL®: Non-Adherent</th>
<th>SILVERCEL®: Non-Adherent (Byslaflair®) Distributed by Vygon Vet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide sustained microbial action</td>
<td>Three or seven days</td>
<td>Re-application required</td>
<td>Seven days</td>
</tr>
<tr>
<td>Facilitates a moist wound healing environment</td>
<td>No, dressing requires re-moistening if wet dressing applied to dry wound.</td>
<td>Yes, but dry with no secondary dressing. Requires frequent re-application. No application difficult.</td>
<td>Offers absorption and retention of exudate to prevent maceration of the wound environment.</td>
</tr>
<tr>
<td>Enable monitoring of the wound with minimal interference</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Manage wound exudate</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Absorb and retain bacteria</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Avoid trauma on removal</td>
<td>Yes but can stick to wound bed if drips during wear.</td>
<td>No - total removal difficult by lavage alone.</td>
<td>Yes - non-adherent presentation of secondary dressing.</td>
</tr>
<tr>
<td>Cost per application</td>
<td>£5.50</td>
<td>£3.50</td>
<td>£2.50</td>
</tr>
</tbody>
</table>

Use of SILVERCEL® in contaminated and infected wounds

The aim in dirty, sloughy, contaminated and infected wounds is to reduce the debris, devitalised protein rich material and the microbial load that has the potential to be a source of infection and prolonged inflammation. The term ‘bioburden’ is used to encompass this detrimental protein rich load that will delay healing if left in situ. Only once the bioburden has been removed will healthy granulation tissue be able to fill the defect effectively.

- Clear the devitalised tissue, slough, and any excess exudate is absorbed while the outer foam layer will help to prevent dehydration.
- Change the dressing after two-three days, and gently cleanse the wound using your normal lavage solution.
- Repeat application until a healthy granulation bed is produced then continue by using normal moist wound management techniques (eg. NU-GEL® and TIELLE®).

Use of SILVERCEL® post debridement and as a preparation for grafting or reconstruction

SILVERCEL® Non-Adherent can be used topically on granulation tissue to promote rapid formation of a wound bed, to decontaminate the wound prior to grafting or to encourage healthy epithelialisation. As the silver is available over a seven day wear time, the dressing is an ideal option for use under casts and bandages where a period of immobilisation is required (see case example).

- After all bleeding has been controlled. Cleanse the wound bed using normal techniques and apply a piece of SILVERCEL® Non-Adherent dressing to the wound to overlap the wound margin by approximately 2cm.
- Cover with a dressing, ideally with a waterproof backing, such as TIELLE® Lite, which will ensure an optimal moist wound environment is maintained.
- The dressing may be left in place up to seven days.
- NB. If the wound is not likely to exude enough to moisten the dressing, or is at risk of drying out apply a layer of NU-GEL® Hydrogel (Vygon Vet) to the wound bed prior to application. Moistening of the dressing with saline or Hartmann’s is also acceptable.

Use of SILVERCEL® for infection control:

There are cases where the risk of contamination and potential complications justifies topical antimicrobial use. Examples include the dressing of sites post arthroscopy to prevent joint contamination, to decontaminate the wound prior to grafting or to encourage healthy epithelialisation. As the silver is available over a seven day wear time, the dressing is an ideal option for use under casts and bandages where a period of immobilisation is required (see case example).

- After surgical closure the wound apply a piece of SILVERCEL® Non-Adherent over the wound.
- Cover with a secondary dressing that provides a waterproof barrier, such as TIELLE® Lite.
- Secure the dressing in place using bandaging and normal techniques as necessary.
- The dressing may be left in place for up to seven days.

Case example: Encouraging healing through wound debridement, immobilisation and removal of bioburden using SILVERCEL® Non-Adherent.

Acknowledgements: Nicky Jarvis, Redwings Horse Sanctuary

‘Harley’ presented to Redwings Horse Sanctuary with a large wound to the knee. Healing had progressed slowly due to movement at the site which combined with tissue deficit had meant the wound had become static and fibrosed. The fibrinous, tough granulation tissue was preventing epithelialisation and contraction (fig 1). The fibrinous granulation tissue was removed using the Versapor® hydrodynamic device (fig 2), and then dressed with SILVERCEL® Non-adherent (fig 3) to ensure there was minimal influence from contamination during immobilisation using a Robert Jones bandage (fig 4).

The wound began to heal rapidly beneath the Robert Jones bandage and SILVERCEL®. Non-adherent maintained the health of the wound throughout. Within a month the wound had radically reduced in size and was progressing very well (fig 5).

Conclusion:

In the last 10 to 15 years silver has become available in just about any form, from ointments to gels, cream, sprays, dressings. Although allergic reactions are rare, some patients may be allergic to silver. Treatment should be stopped at all allergic reaction is suspected.

No longer a first line in wound management, antibiotics are no longer a first line in wound management, antibiotics are no substitute for effective debridement and cleansing

Silver should not be used in patients being processed for MRI scanning due to the metallic component in the dressings.

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