

Consider the whole patient, not just the hole: healing a wound cavity by secondary intention

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Abstract

This case study demonstrates the effective management of an infected wound cavity by the use of an antimicrobial wound product, Aquacel Ag. This helped to promote wound healing by secondary intention in a time effective manner, thereby achieving best patient outcomes. Selecting a wound dressing product depends on accessibility, ease of use, the location of the wound, the type of tissue present on the wound bed, the depth of the wound, exudate levels and the condition of the peri-wound skin. The impact on wound healing from inappropriate selection of wound dressing products, for example Betadine-soaked gauze, and the subsequent effect on the wound healing process, is discussed.

Introduction

Ms W was a 77 year old lady requiring wound care management of an infected abscess on her right forearm following a cat bite. Post incision and drainage of the abscess, the wound cavity measured 10mm long by 10mm wide and 10mm deep, extending to the subcutaneous tissue layer (Figure 1). The wound bed consisted of 100% granulation tissue, it was malodorous and was oozing large amounts of haemoserous exudate.

The wound cavity initially looked like a simple wound to attend to, but this was where the concept of considering the whole person not just the hole came into effect. To minimise the risk of the wound cavity progressing to a sloughy type wound as shown in Figure 2, a comprehensive holistic assessment was performed to help identify any risk factors that could potentially delay or impact on the wound healing process.

The holistic process

Intrinsic and extrinsic factors impacting on the wound healing process included her age, an existing wound infection,

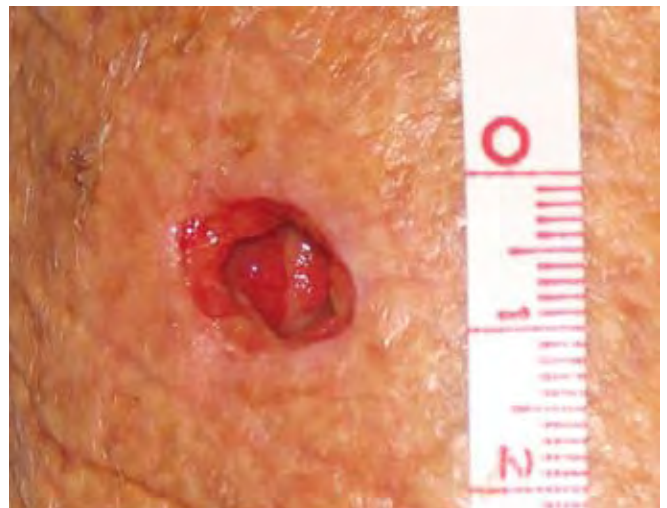


Figure 1. Post-incision and drainage of abscess.

decreased appetite and her long-standing history of anaemia. Wound swab results revealed that Ms W's wound cavity was infected with *Pasteurella multocida*, which is a common aerobic Gram-negative coccobacillus organism found in cats¹. Joint or bone involvement can cause osteomyelitis and systemically can lead to endocarditis, meningitis and intra-abdominal infections². Further, an infected wound inhibits the migration of fibroblasts and epithelial cells across the wound bed and can prevent wound contraction from occurring³. Often with infection, excessive exudate is produced by the matrix metalloproteinases (MMPs) due to an increase in pro-inflammatory activity⁴. Ms W's long-standing anaemia was potentially limiting red blood cells, oxygen and nutrients from reaching the damaged wound tissue⁵.

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Figure 2. A sloughy type wound.

In addition, Ms W was experiencing loss of appetite which was putting her at high risk of deficiencies in essential vitamins, minerals, protein and carbohydrates. Deficiencies in these areas were potentially impairing the wound healing process by altering the inflammatory cell response, and inhibiting the production of growth factors and the activity

of the macrophages, thereby causing the production of fibroblasts to be slower, the growth of granulation tissue to be impaired and collagen synthesis to be inhibited^{6,7}. Decreased collagen synthesis can potentially cause wound dehiscence⁶. With age, the epidermal cell turn-over rate is slower, there is decreased tissue oxygenation and capillaries become more fragile, making skin less vascular, drier and having a reduced wound tensile strength. These all contribute to an inability to retain moisture and elasticity⁶.

Wound management plan

Initially the surgeon wanted the wound cavity to be dressed with Betadine-soaked gauze packing to assist with the wound healing process but, as the literature shows, this type of dressing technique is contraindicated for a number of reasons^{9, 10}. Gauze dressings are unable to cope with excessive amounts of exudate produced by a wound cavity and can lead to the surrounding peri-wound skin becoming macerated⁹. Dried out gauze adheres to the new granulation tissue, causing pain and tissue damage upon removal, often requiring analgesia prior to removal¹⁰. Due to gauze dressings creating a dry environment, this can potentially affect the proliferation phase of wound healing by preventing

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the migration of fibroblasts across the wound bed and delaying wound closure¹⁰. A dry wound bed can also lead to the formation of a scab which further inhibits the migration of epithelial cells across the wound bed, forcing the cells to find a way of migrating underneath the scab, resulting in delayed healing¹¹.

In developing a wound management care plan, five areas were considered:

- Preventing peri-wound maceration and skin breakdown from wound exudate.
- Decreasing the bacterial burden at the wound site to prevent further wound breakdown and a delayed healing process from an existing wound infection.
- Minimising pain at wound site during dressing changes.
- Preventing premature bridging and epidermal closure of the wound cavity, rather promoting complete healing from the base of the wound to the skin's surface.
- Maintaining the correct moisture balance to facilitate healing.

An interdisciplinary team approach, including dietitian intervention to help address Ms W's malnutrition as well as ongoing reviews by the haematologist, was already in place to closely monitor Ms W's anaemia and provide blood transfusions as required.

After much discussion with the surgeon, a compromise was reached where selection of an alternative dressing product to

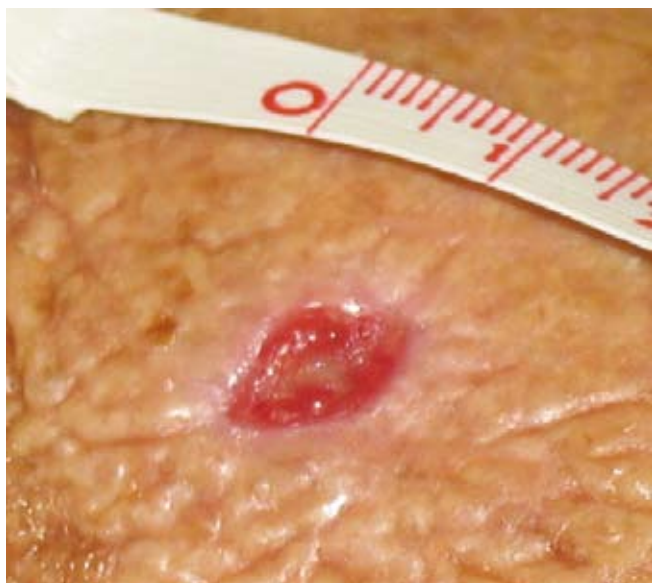


Figure 3. One week after using Aquacel Ag ribbon.

Betadine-soaked gauze, in line with best practice principles was chosen. To promote wound healing by secondary intention, a wound management plan using Aquacel Ag ribbon twice weekly was initiated. A semi-permeable foam (Mepilex border) was used as a secondary dressing for added absorbency and protection.

Aquacel Ag

Aquacel Ag ribbon, a sustained silver-releasing dressing, was selected for its antimicrobial properties to provide a balanced bacterial environment and to reduce the risk of bacterial colonisation of the wound site. Silver helps to accelerate the healing process by stimulating the activity of growth factors and cytokines and helps to rupture the wall of the bacterial cell, thus inhibiting bacterial cellular division and replication⁴. Silver impregnated dressings have a broad spectrum antimicrobial activity and are effective against Gram-negative, Gram-positive, anaerobic and aerobic bacteria, methicillin-resistant *Staphylococcus aureus* and vancomycin-resistant *Enterococcus*⁴.

Aquacel Ag ribbon was also chosen for its ability to absorb moderate to large amounts of exudate, to help achieve and maintain the correct moisture balance and to assist with cell migration across the wound bed¹². Aquacel Ag has a high fluid handling capacity; it has the ability to absorb up to 22 times its weight in fluid and thus assists with exudate management by removing and locking away excessive tissue fluid from the wound bed¹³. When mixed with exudate, Aquacel Ag breaks down in to a gel, promoting non-traumatic removal of the dressing and reducing disruption to new epithelial growth¹⁴. If Aquacel Ag does adhere to the wound bed, then the dressing can be easily removed by pre-soaking with warmed normal saline or tepid water before removal¹³.

Aquacel Ag has an extended wear time and can be left in situ for up to 1 week depending on the level of exudate, thus helping to maintain correct wound temperature by providing thermal insulation and minimising the risk of exposure to airborne aerobic infections¹⁵. The optimal temperature for wound healing and tissue repair is 37°C¹⁵; wound healing can be delayed by several hours if the wound temperature decreases by just 1°C¹⁶. Further, the wound cavity was lightly packed to approximately 80% with Aquacel Ag ribbon to dead space in the wound whilst allowing space for the swelling of the hydrofibre dressing to occur¹³. Elimination of dead space helps to prevent the formation of abscesses, haematomas and the formation of a breeding ground for bacteria. It also helps to prevent bridges from forming which could lead to the premature closure of the epidermis¹⁷.



Figure 4. Re-epithelialisation achieved after 16 days of treatment.

Outcomes

After 7 days of using Aquacel Ag, the wound dimensions had decreased in length by 2mm, in width by 5mm and in depth by 8mm (Figure 3). The wound bed consisted of 5% epithelialised tissue and 90% granulation tissue. However,

5% slough had developed in the centre of the wound bed. Haemoserous exudate remained at a moderate level. Despite the formation of the new slough, Aquacel Ag was continued for a further 2 weeks for its antimicrobial properties¹⁸. After 16 days of using Aquacel Ag ribbon, which included a total of six dressing changes, complete healing by secondary intention and re-epithelialisation was achieved (Figure 4).

Cost comparison

A cost comparison between using Aquacel Ag as the primary dressing and Betadine-soaked gauze over the same time period was conducted. Table 1 shows the predicted cost of using Betadine-soaked gauze packing on a daily basis versus treatment costs over the same 16 day period using Aquacel Ag; a minimum saving of \$179.15 is predicted. Note that the costings shown do not include the cost of gloves and waste disposal associated with both types of dressings.


Despite the Betadine-soaked gauze dressing being relatively inexpensive, accumulated costs are evident with nursing time and the frequency of dressing changes required. Note also that the costings for Betadine-soaked gauze do not include the cost of analgesia that may be required prior to removing

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Table 1. Costings for Betadine-soaked gauze dressings used daily for 16 days versus costings for Aquacel Ag dressings used twice weekly for 16 days (six applications). Cost of consumables obtained via pharmacy and stores department at The Prince Charles Hospital.

Product	Cost	Betadine-soaked gauze		Aquacel Ag	
		Number	Total	Number	Total
Bottle of Betadine	\$2.20 each	1	\$2.20	–	–
Gauze packing (1.25cm x 1m)	12c each	16 (1 per day)	\$1.92	–	–
Aquacel Ag	\$20.07 each	–	–	1	\$20.07
Mepilex border dressing (7.5x7.5cm)	64c each	16 (1 per day)	\$10.24	6	\$ 3.84
Dressing packs	51c each	16 (1 per day)	\$8.16	6	\$ 3.06
Normal saline 30mls vial	70c each	16 (1 per day)	\$11.20	6	\$ 4.20
Disposable sterile scissors	\$1.10 each	16 (1 per day)	\$17.60	6	\$ 6.60
Visitrax depth probe	\$1.46 each	3	\$3.38	3	\$ 3.38
Nursing visits	\$16.46/30 mins	16 (1 per day)	\$263.36	6	\$98.76
Total			\$318.06		\$139.91

a dried-out Betadine gauze packing that has adhered to the wound tissue. Further, with gauze dressings there is also the risk of fibres being left embedded in the wound and the dressing change becoming a time consuming procedure to perform¹⁹. Also, gauze type dressing would need to be remoistened 3-hourly to provide the correct level of moisture at the wound bed site²⁰.

Conclusion

Aquacel Ag had a positive impact on wound healing. This most likely occurred by achieving the correct moisture balance, providing a balanced bacterial environment and assisting with stimulating granulation tissue production and re-epithelialisation, ultimately healing the wound in a timely manner. Wound care can become costly just by implementing ineffective wound care practices and can potentially cause prolonged healing times and unnecessary frequent dressing changes.

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