Wound malodour and the role of ACTISORB® Silver 220

Here, the author reviews the clinical issues around wound malodour, its causes, assessment, and management. The use of activated charcoal and silver dressings is discussed, and the evidence for use of ACTISORB® Silver 220 is presented, along with a case study.

KEY WORDS
- Activated charcoal
- Silver
- Wound malodour

The concept of "septic germs" causing suppurative inflammation, delayed healing and putrefaction in wounds has been known for quite some time (Lund 1869); indeed, the author refers to the need for antiseptic (carbolic) in the dressing to resolve the problem. Wound malodour has been described as "probably the most distressing symptom for patients" (Haughton and Young, 1995; Young, 1997) as it can affect the patient, their family and carers (Van Toller, 1994).

The impact of malodour should never be underestimated; it can cause depression and social isolation of the patient, which may impact on social and family relations (Van Toller, 1994). Recent psychology studies have established just what impact chronic wounds have (Upton et al, 2012; 2013). Furthermore, the presence of malodour has been found to induce a loss of appetite and inhibit intimacy, thus further reducing quality of life. For those patients with fungating wounds, the impact of malodour will be compounded with the problems of life with a progressive and incurable disease (Naylor 2002). In a study on cancer patients, malodour was found to significantly reduce quality of life (Lo et al, 2012).

Having established the psychosocial impact, the cause(s) are well known, as are the remedies. Nevertheless, wound malodour is still a frequent complication, which, despite the above, remains poorly managed. This review will look at the causes of malodour and the evidence for eliminating or masking it. In particular, the evidence supporting the use of a dressing containing activated charcoal and silver (i.e. Actisorb Silver 220; Systagenix).

CAUSES OF WOUND MALODOUR

Despite being a frequent problem, there is very little research on wound malodour, particularly on prophylaxis and management. There is, however, much anecdotal evidence and reported clinical experience that provides some guidance. Perhaps the first point to emphasise is that not all malodorous wounds are infected (Bowler et al, 1999; Fletcher, 2008).

Although every wound has the propensity to become malodorous, it is generally those wounds that heal by secondary intention (such as leg ulcers, pressure ulcers and diabetic foot ulcers) and those which are not expected to heal (such as fungating wounds) that present as a management problem (McManus, 2007). It is generally accepted that malodour is attributable to the metabolism of anaerobic bacteria; however, Bowler et al (1999) claim a mixed microbial (aerobes–anaerobes) cause. Nevertheless, anaerobes are invariably involved as has been reported by numerous authors, usually in association with devitalised tissues (Naylor, 2002). It is, however, due to the generation of volatile chemicals via bacterial metabolism, which results in the characteristic offensive smell. Typically these are short-chain fatty acids (e.g. butyric acid), sulphur-based compounds (e.g. hydrogen sulphide, thiols, mercaptans) and aromatic amines (e.g. putrescine, cadaverine formed by the fermentation of amino acids).

BACTERIA IN CHRONIC WOUNDS

Numerous investigations of the microbial flora of chronic wounds have been conducted in recent years. Depending on the techniques of sampling and identification used (i.e. 'traditional' or molecular diagnostics), differing populations are defined. In general, such wounds will harbour aerobes, anaerobes and Gram-positive and -negative bacteria. Typically, this 'wound microbiota' (as it is now known) varies with body site and with each person.

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The usual chronic wound-colonising organisms include the anaerobes Peptostreptococcus and Bacteroides spp.; Staphylococci, notably *S. aureus* and *S. epidermidis*; Streptococci spp. such as *S. pyogenes*; and Pseudomonads, usually *P. aeruginosa*. The microbiology of wounds is not a subject that can be adequately addressed here, the reader is directed towards authoritative texts for a greater insight of this complex topic (Kirketorp-Moller et al, 2008; Percival and Dowd, 2010).

The offending organisms that cause malodour are commonly Prevotella spp., Porphyromonas spp., Bacteroides spp. in conjunction with Enterococci (i.e. faecal streps) and coliforms. The presence of Bacteroides spp. and their potential to develop bacteraemia is worthy of note (Kanj et al, 1998). However, it should be remembered that malodour does not necessary mean a wound is infected.

PRINCIPLES OF WOUND MANAGEMENT

The following general principles apply for wound management, regardless of the presence of malodour:

- Debride devitalised tissues as they provide a favourable growth environment for bacteria.
- Control the bioburden according to wound status (i.e. delayed healing/critical colonisation, local or spreading infection) using the appropriate topical or systemic agents (Kingsley, 2001; Lipsky and Hoey, 2009).
- Control exudates, especially to achieve an 'optimum' moist environment (Bishop et al, 2003), taking care to avoid 'strike through' (Alexander et al, 1992; Popovitch et al, 1995) – a violation of the basics of asepsis.
- Address the underlying pathology with appropriate measures.
- Specific measures for malodour are to minimise or eliminate the odour and to control the offending bioburden. The former is a symptomatic measure, the latter is remedial; ideally, both are necessary. Logic dictates that the source of the malodour (i.e. the wound bioburden) should be controlled using targeted antimicrobials, topical and/or systemic. Mere odour control is insufficient.

Holloway (2004) stresses that: "Management of malodorous wounds calls for the clinician to be resourceful in using topical treatments as well as applying dressings."

ACTIVATED CHARCOAL

Activated charcoal has a long history of medical use, being a material with powerful adsorbent properties that are effective in reducing malodour (Kerihuel, 2009). Its first use on wounds is unclear. In a report by Beckett et al (1980), being the earliest found, the authors described the clinical evaluation of an activated charcoal cloth within a porous nylon sleeve in 26 patients with venous leg ulcers and 13 with suppuration post-operative wounds; it was found to be effective in reducing the malodour. Furthermore, microscopic analysis revealed that the cloth adsorbed the bacteria (i.e. bacteria were bound to the cloth fibers), such that many can be removed with the dressing (Beckett et al, 1980), a well-known characteristic of activated charcoal (Naka et al 2001). This material was the prototype of Actisorb (J&J, now Systagenix). Further clinical evaluation, a randomised controlled trial, was published by Mulligan et al (1986) as well as a case cohort (Bornier and Jeanin, 1989).

Since that time, activated charcoal dressings have been marketed by many companies and widely used (Naylor, 2002; de Laat et al, 2005; Hampton, 2008; Fletcher, 2008; Morris, 2008).

The activated charcoal in Actisorb has been found to have another potentially important attribute, that of toxin adsorption from wounds (Muller et al, 2003) – a feature apparently unique to this dressing. Although as yet unproven in most wounds, the removal or inactivation of bacterial toxins is important in reducing morbidity in burns – even if the source bacteria have been killed (Rosenthal, 1982).

SILVER ANTIMICROBIAL

Much has been written about silver as an antimicrobial for topical use and there are many silver-containing products for wound care management on the market. Numerous reviews have presented its mode of action and clinical evidence (Carter et al, 2010; Elliott, 2010; Toy and Macera, 2011). Of note, silver is known to be a broad-spectrum agent with a low propensity to select for resistant organisms and an excellent safety profile in wound care. It is one of a number of topical antimicrobial agents that have been successfully used to reduce bioburden, others being iodine, honey and polyhexamethylene biguanide (White et al, 2006).

Table 1. Cost analysis of treatment of chronic wounds treated with ACTISORB® Silver 220 (AS220) or antibiotics (Cassino et al, 2001)

	AS220 group (*n*=75)	Antibiotic group (*n*=75)
Global costs (US$)	1542.85	9898.57
Average daily cost (US$)	110.20	932.55
Average daily cost per patient (US$)	1.45	12.43
Effectiveness (%)	94.6	97.3
Average treatment period (days)	14	10.4
30-day recurrence (%)	1	12

"Silver is one of a number of topical antimicrobial agents that have been successfully used to reduce bioburden."

As has been shown, malodour is associated with anaerobe colonisation, and the use of silver to reduce bioburden will also reduce anaerobes and therefore malodour (Kerihuel, 2009).

EVIDENCE FOR ACTISORB SILVER 220

Actisorb Silver 220 (Systagenix) has existed in a number of guises for many years having been launched in the UK as Actisorb in 1985. In 1987 silver was added and in 2000 it became known as Actisorb Plus, before being renamed Actisorb Silver 220. It has considerable clinical evidence to support its use (Mulligan et al, 1986; Bornier and Jeanin, 1989; Millward, 1991; Wunderlich and Orfanos, 1991; Tebbe and Orfanos, 1996; Cassino et al, 2001; White, 2003).

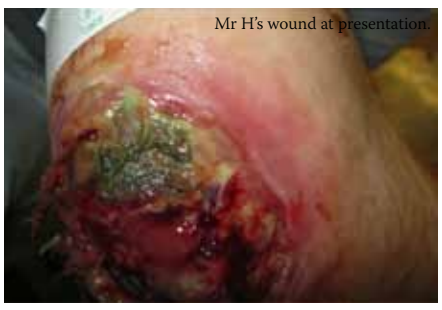
In the study by Cassino et al (2001), systemic antibiotics were compared with topical (AS220) in 150 patients with localised infection. The results showed both treatments to be effective; however

Box 1. A case report of use of ACTISORB® Silver 220. This case was supplied by Dr Paul Chadwick and Samantha Haycocks (Salford Royal Foundation Trust, Salford, UK)

Background and presentation

Mr H, an 82-year-old man, presented to the authors' diabetic foot clinic in May 2012 with a pressure ulcer (88 mm × 66 mm) on his left heel (*below*). The ulcer had been present for more than 6 months and during this time the wound had been treated with Sorbion (HR Healthcare). Mr H had just completed a course of clindamycin to manage infection. He had profound peripheral neuropathy.

At presentation the wound did not appear to be infected but was considered to be critically colonised. The wound base was 90% slough, with a high volume of exudate. The periwound skin was macerated with slight erythema. Mr H's key concern was the foul smell of the wound which had been present for 1 week.



Mr H's wound at presentation.

Following assessment, Mr H's wound was dressed with Actisorb Silver 220 to manage the odour and control bioburden. District nursing staff ensured delivery of all necessary pressure-relieving devices and patient education to Mr H.

Wound progress

Week 1: On reassessment there was no change in the appearance of the wound. However the odour had reduced significantly. Treatment was continued.

Weeks 2–3: Due to illness, Mr H was unable to attend the clinic for 2 weeks, however, treatment with Actisorb Sliver 220 continued with district nurses carrying out home visits to change the dressing.

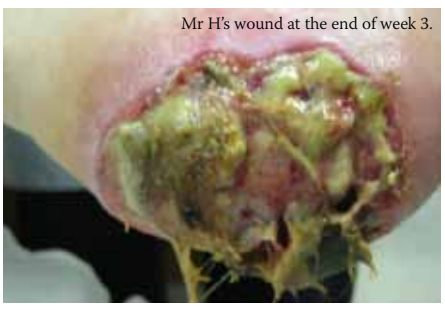
Week 4: Mr H was well enough to return to clinic. Although the wound had not decreased in size (90 mm × 60 mm; *right*), there was a noted improvement with an increase in granulation tissue (50–75% of wound base) and there was no malodour. Ertrapenem (1 g daily) was commenced to manage osteomyelitis discovered in Mr H's calcaneum.

Week 5: On the final visit, the wound again appeared static with a slight reduction in granulation tissue. Odour was still controlled and although the wound bed had not improved, the erythema and maceration to the surrounding skin had improved significantly. A WOUNDCHEK™ Protease Status test was carried out and protease levels were found to be low.

Conclusion

Clinician rated Actisorb Silver 220 as satisfactory in terms of ease of use. While there was no marked decrease in the size of the wound, malodour was quickly eliminated, and there was improvement in the surrounding skin and a reduction in slough.

During periods of acute illness, chronic wounds – particularly pressure ulcers – can deteriorate rapidly. However, during the treatment period, Mr H's wound did not deteriorate, malodour was eliminated, there was improvement in the surrounding skin, and a reduction in slough. These outcomes were considered to be positive, particular as he had underlying osteomyelitis.



Mr H's wound at the end of week 3.

"The impact of malodour on the patient, and all who come into contact with them, must not be underestimated."

Actisorb Silver 220 proved more cost-effective (*Table 1*) and led to fewer recurrences in the short term. In addition to these clinical reports, Furr et al (1994) have conducted *in vitro* antibacterial studies, finding that Actisorb Plus (activated charcoal cloth with silver) and solutions of silver nitrate, but not Actisorb (activated charcoal cloth without silver), demonstrated antibacterial activity against Gram-negative and Gram-positive bacteria. This activity was unimpaired in the presence of plasma. Sodium thioglycollate was an effective neutraliser of Actisorb Plus and of silver nitrate, indicating that the release of silver from Actisorb Plus contributed to the antibacterial activity of the dressing.

CONCLUSIONS

Wound malodour often reflects a problem with the wound and, as such, requires investigation and active management as appropriate. The impact of malodour on the patient, and all who come into contact with them, must not be underestimated. Where the cause is thought to be of microbial origin, it is important to deal with the bioburden, and, the odour. In this respect, a topical antimicrobial combined with activated charcoal is a favourable option. Actisorb Silver 220 dressing combines these two entities and is evidence-based. WUK

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