

Malodour in diabetic foot wounds

Fiona Murray

ARTICLE POINTS

1 All practitioners must be aware of the huge burden of living with a malodorous foot wound and recognise their duty to reduce this burden as much as possible with appropriate management strategies, and dressings to minimise the impact upon the patient.

2 An important aspect of malodorous wounds is the patient's perspective.

3 Due to the poly-microbial nature of foot wounds anaerobic bacteria are common and are a significant cause of the malodour.

4 Sharp debridement of necrotic and sloughy tissue carried out by a skilled podiatrist is a fast and effective way of reducing malodour.

5 Exudate that is poorly managed and allowed to stagnate is a cause of wound malodour that can be addressed by appropriate dressings.

KEY WORDS

- Diabetic foot wound
- Malodour
- Exudate
- Dressing

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Introduction

Five per cent of the total NHS budget is spent on treating diabetes and its complications; this equates to £3.5 billion a year, or – more frighteningly – £111 per second (Department of Health, 2001). In the UK, it is estimated that 5% of the diabetes population (approximately 90 000 people) will develop a foot ulcer in any one year (National Institute for Clinical Excellence, 2004). None of these figures is able to encapsulate the personal cost of social isolation and psychological stress for those people that unfortunately develop foot ulcers. This cost is magnified many times when the wound that the person has to live with is malodorous. The cost, both psychologically and socially, is extremely high; yet there is a dearth of literature on this particular aspect of diabetic foot-related complications. This article highlights some factors which affect malodorous foot ulcers and some successful treatments for them. Also discussed are the psychological aspects of living with malodorous foot ulcers.

Neal (1991) defined malodour as: 'Any wound assessed as being offensive (smelly) by the patient, carer or practitioner.' There are a number of contributing factors within a wound that contribute to the production of an unpleasant odour. A few are described later in this article.

A literature review was carried out as part of the research for this article using a computerised database search using the terms 'diabetes', 'malodorous', 'wounds', 'body image' and 'patient perception'. The databases searched were MEDLINE, the Cochrane Library, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), the British Nursing Index, Ovid, HighWire, Proquest, Blackwell Synergy, Springer Link, *The Journal of Wound Care* and *The Diabetic Foot* journal. The searches did not reveal any literature specific to malodorous diabetic foot wounds. Most of the information relating to malodorous wounds has been written about fungating wounds, squamous cell carcinoma and breast cancer (Wilson, 2005; Collier, 2000; Enoch et al, 2004; Fiegl et al, 2001; Lund-Nielsen et al, 2005). Those of us involved in caring for people with diabetic foot complications are aware that diabetic foot wounds are as susceptible to developing an unpleasant odour as other types of wounds

such as pressure sores and leg ulcers.

Causes of malodour

Devitalised tissue

Malodour is not confined to a specific type of wound. However, it is commonly associated with certain types of tissue within a wound, such as sloughy or necrotic tissue as illustrated in *Figures 1* and *2* (Collier, 1997; Moody, 1998; Bowler et al, 2001). These tissue types provide a perfect environment in which anaerobic and aerobic bacteria can thrive and an ideal medium for many bacterial species (Haughton and Young, 1995; Moody, 1998).

Diabetic foot wounds are commonly poly-microbial and many studies have isolated three to five species, including aerobic Gram-positive cocci and Gram-negative rods as well as obligate anaerobes (Bowler et al, 2001). Frequently isolated species include *Pseudomonas*, *Peptostreptococcus*, *Bacteriodes* and *Clostridium*, all of which have been isolated in up to 36% of diabetic foot infections (Wheat et al, 1986). This mixture of slough, subcutaneous fat and the end products of healing such as white blood cells and dead bacteria stagnate to produce a distinctive musty or fetid odour (Neal, 1991).

Putrefaction, the decomposing of matter



Figure 1. Non-healing trans-metatarsal amputation site exhibiting sloughy tissue.

by bacteria, takes place in devitalised tissue. The resulting chemical products are characterised by noxious and putrid odours. The most common chemical products are cadaverine, ammonia, trimethylamine and putrescine (Williams and Griffith, 1999). Production of ammonia leads to the all too familiar 'rotting onions' smell.

Infection

Figure 3 shows a heavily infected toe with frank gangrene. The role anaerobic bacteria

play in causing malodour and in the delay of healing of such wounds has not always been considered as important as aerobic and facultative bacteria (Bowler et al, 2001) but is becoming better understood. Goldstein stated that the presence of anaerobic bacteria in foot ulcers of people with diabetes has been associated with a greater likelihood of the individuals becoming febrile, developing a more serious deep-wound infection and requiring an amputation (Goldstein, 1994). Bowler et al (1999) found that wound malodour was associated with increased numbers of anaerobes, in particular Gram-negative species.

Malodour is associated with the metabolic end products of anaerobic activity such as propionic, isobutyric and butyric acids (Collier, 2000). Many clinicians will conclude that a wound has a significant anaerobic infection based purely on the wound characteristics, before the cultures are available, due to the very distinctive odour that an anaerobic infection produces. These wounds are commonly ischaemic, rather than neuropathic, in their primary aetiology (see Figure 2 for an example). The ischaemic element contributes to the tissue hypoxia which favours the development of anaerobic bacterial growth within the wound (Silhi, 1998).

Exudate

Exudate that is not properly managed will lead to malodorous diabetic foot wounds. Collier (1997) and Neal (1991) cite stagnant exudate as a cause of malodour in fungating wounds; therefore, it is reasonable to assume that it is also a factor in diabetic foot wounds (Figure 4). Exudate becomes malodorous if it is allowed to collect and stagnate within the wound, dressings, bandages, hosiery and footwear.

Unlike fungating wounds or leg ulcers there are fewer diabetic foot wounds that produce copious amounts of exudate; there are, however, a large number of wounds that produce moderate amounts of exudate on a consistent basis. Dressings used on diabetic foot wounds are walked upon, which can reduce their ability to retain the exudate; so a moderately



Figure 2. An ischaemic necrotic heel ulcer.



Figure 3. A heavily infected toe with frank gangrene.

exuding wound can still be difficult to manage if the patient is weight-bearing.

Reducing malodour in diabetic foot wounds

The primary treatment aim when dealing with malodorous diabetic foot wounds is to identify and remove the cause of the malodour as quickly as possible.

Removing necrotic or sloughy tissue Sharp debridement

Many podiatrists involved in the care of the diabetic foot will, unwittingly, address one of the major causes of malodour: slough and necrotic tissue. Sharp debridement is one of the foremost tools skilled podiatrists use in treating diabetic foot wounds. Removal of the necrotic tissue will have an immediate effect on the level of malodour from the wound. (Bowler et al, 2001). It is the quickest way of improving the situation and is routinely performed by podiatrists at every dressing change. If the main care provider is, for example, a nurse who does not routinely perform sharp debridement, referral to a podiatrist should be sought. Surgical debridement may be required when there is a significant amount of tissue that needs removing. However, there are times, specifically in the ischaemic diabetic foot, where surgical debridement is not possible and ongoing sharp debridement is not desirable or possible as,

for example, poor perfusion and ongoing surgical procedures may produce a wound which will not heal. Alternatively, the healthcare professional may be aiming for palliative care. These patients therefore have to be managed in a different way.

Larval therapy

Larvae (or maggots) are increasingly being used in patients with chronic ulceration. Using larval therapy, Wolff and Hansson demonstrated a 58% reduction in odour of the foul-smelling ulcers in their study (Wolff and Hansson, 2003). They concluded that the larvae thrived in the diabetic wounds, achieving complete debridement (Figure 5). Larval therapy is a good, safe alternative for nurses in localities where accessing podiatrists skilled in sharp wound debridement is difficult.

The application of this therapy may be problematic to some patients for psychological reasons. Larvae are commonly associated with rotting meat; patients with malodorous wounds may find this association difficult to handle as it may reinforce their view that they are themselves decaying or rotting. The acceptance of larval therapy by patients has been investigated by Kitching (2004); he concluded that larval therapy is acceptable to most patients if consideration is given to those aspects which repulse them. The fact that larvae will reduce the malodour of a wound very quickly may be a strong reason for patients to accept the therapy.

Reducing infection

Infections should be treated immediately with antibiotic treatment; this is initially empirical and should cover the most common pathogens (Armstrong and Lipsky, 2004). Necrotic, gangrenous or foul-smelling wounds should prompt anti-anaerobic therapy (Lipsky, 2004); in the UK, this is commonly metronidazole taken orally, by intravenous injection or as a topical gel (Metrotop; SSL International, Knutsford). Metronidazole has been recognised as contributing to the reduction of wound odour since the 1970s (Jones et al, 1978) and a number of studies have been carried out since (Sparrow et al, 1980; Ashford et al, 1984; Bower et al, 1992)

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1 Removal of necrotic tissue will have an immediate effect on the level of malodour from the wound.

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Figure 4. Post amputation wound with slough and heavy exudate.

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1 Metronidazole taken orally or intravenously will reduce the bacterial load in the wound as long as there is an adequate blood supply to achieve therapeutic tissue concentrations.

2 It is imperative when dealing with a heavily exuding wound that an appropriate dressing is chosen.

3 Patients commonly wear just one pair of shoes or off-loading device for the lifetime of their lesion, which may be many months. This gives the footwear or off-loading device ample time to soak up exudate and so contribute to the malodour of a wound.

which have demonstrated an effect, although these studies were underpowered. Despite the fact there is no robust scientific evidence to support the use of metronidazole in malodorous diabetic foot wounds, there is a significant body of anecdotal evidence indicating that it has a beneficial effect. Metronidazole taken orally or intravenously will reduce the bacterial load in the wound as long as there is an adequate blood supply to achieve therapeutic tissue concentrations. This may not always be the case, particularly in ischaemic wounds, therefore, topical application may be preferable.

Despite a number of trials using metronidazole, the best method of delivery and the optimum length of treatment or dose have yet to be ascertained (Clark 2002; Ashford et al, 1980; Ashford et al, 1984; Sparrow et al, 1980).

Managing exudate

It is imperative, when dealing with a heavily exuding wound, that an appropriate dressing is chosen. There are numerous different types of dressings: foams, alginates and hydrofibres to name but a few. These dressings must be changed as often as necessary to cope with exudate levels. Consideration must be given to the fact that whatever dressing is chosen, its ability to retain exudate will be affected by the amount of weight-bearing the patient does.

Another major factor is that patients commonly wear just one pair of shoes or off-loading device for the lifetime of their lesion, which may be many months. This gives the footwear or off-loading device ample time to soak up exudate and so contribute to the malodour of a wound. The sponge effect of the plaster of paris used in a total contact cast (TCC) can be a significant barrier to some patients. A TCC left in place for any length of time (a week or more) can become smelly and offensive. Many patients will not accept one because of this – despite the fact that the technique is successful in reducing the lesion.

Dressings used in malodorous wounds

Metronidazole gel

In the authors' experience, metronidazole gel and a secondary dressing such as a charcoal-based one will control a significant level of the malodour. The metronidazole addresses the anaerobic bacterial cause of the malodour (Ilori et al, 1996), while the charcoal absorbs the wound odour. This two-pronged approach has major benefits. The odour is initially reduced by the charcoal dressings, which the patient sees as an immediate benefit, and the metronidazole gel will reduce the number of odour-producing bacteria.

Activated charcoal dressings

Activated charcoal is used in a number of dressings, such as Lyofoam C (Seton Scholl Healthcare, Oldham) and Carboflex (Convatec Ltd, Middlesex). In the authors' experience, they all absorb odour from the wound, but do not address the causes of the malodour.

Silver dressings

The antimicrobial properties of silver have been known for a long time and new formulations such as Acticoat and Acticoat-7 (Smith and Nephew Healthcare, Hull) reduce the wound odour by their sustained action on the bacterial load of the wound.

Combination dressings

Actisorb Silver-220 (a charcoal dressing containing silver; Johnson and Johnson Medical, Ascot) and Acticoat Absorbent (a

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1 Dressings should be as practical as possible to facilitate patients bathing or showering.

2 Total contact casts may need to be replaced earlier than the lesion dictates to reduce the smell to a bearable level for the patient, particularly in the summer.

slow-release silver dressing which is able to absorb high levels of exudate; Smith and Nephew Healthcare, Hull) are useful, as they address more than one aspect of the malodorous wound.

This list is not exhaustive and there are many products that can be used to manage malodour. Each wound must be judged on an individual basis and the most suitable product or combination of products must be chosen for an individual patient.

The patient's perspective

Perhaps the most important but under-researched aspect of malodorous diabetic foot wounds is the patient's perspective. Much has been published on the patient's perspective of living with a fungating wound, and the associated social isolation and altered body image (Piggin, 2003; Goode, 2004; Hack, 2003).

Any wound or defect in the skin can cause an individual distress, leading to an alteration of body image (Magnan, 1996). Altered body image is described by Price as:

'a state of personal distress, defined by the patient, which indicates that the body no longer supports self esteem, and which is dysfunctional to individuals, limiting their social interaction with others. Altered body image exists when coping

strategies are overwhelmed by injury, disease disability or social stigma.'

(Price, 1995).

This must be much worse when the lesion is covered and effectively out of sight, yet there is a constant reminder of the lesion due to the pervasive smell. People describe living with a malodorous wound as 'devastating' (Haughton and Young, 1995). Those with a malodorous wound are likely to withdraw from social interactions and suffer from general depression (Hack, 2003). Yet, despite this, there is little in the literature that examines the patient's perspective on living with a malodorous diabetic foot wound. What literature that does exist (for example, Ashford et al, 2000; Searle et al, 2005) does not specifically explore the issue of malodour. We all have anecdotal evidence from our own case loads of those patients who will abandon normal daily living activities because of the smell of their ulcers, or those that spray their dressings with air fresheners.

Conclusion

All practitioners must be aware of the huge burden a malodorous wound is to the person living with it. As healthcare professionals, we have a duty to reduce this burden as much as possible. In addition to using the latest dressings appropriately, we need to address the causes of malodour.

Treatment approaches must be patient-centred. Dressings should be as practical as possible to facilitate bathing or showering. Providing protective devices such as Aquashield (Peacocks Medical Group, Newcastle upon Tyne) or Limbo Cast Protectors (Thesis Technology, Chichester) enables patients to bath or shower while still keeping their dressings dry, therefore, giving them the psychological boost of feeling clean. If circumstances allow, footwear or off-loading devices should be either washable or replaced on a regular basis, and patients should be provided with extra socks or liners. TCCs may need to be replaced earlier than the lesion dictates to reduce the smell to a bearable level for the patient, particularly in the summer.

In the authors' experience, the overall percentage of malodorous diabetic foot



Figure 5. Maggots in a diabetic foot wound can achieve complete debridement.

‘All practitioners must be aware of the huge burden a malodorous wound is to the person living with it. We have a duty to reduce this burden as much as possible.’

wounds is small but the huge burden these patients face is significant. Therefore, malodour in diabetic foot wounds is an area that needs further investigation, in terms of ways to treat it, understanding the patient's perspective and helping patients achieve a better quality of life. ■

- Armstrong DG, Lipsky BA (2004) Diabetic foot infections: stepwise medical and surgical management. *International Wound Journal* 1(2): 118–9
- Ashford RF, Plant GT, Maher J, Pickering D, Coe MA, Drury A et al (1980) Metronidazole in smelly tumours. *Lancet* 1(8173): 874–5
- Ashford R, Plant G, Maher J, Teare LJ (1984) Double-blind trial of metronidazole in malodorous ulcerating tumours. *Lancet* 1(8388): 1232–3
- Ashford RL, McGee P, Kinmond K (2000) Perception of quality of life by patients with diabetic foot ulcers. *The Diabetic Foot* 3(4): 150–5
- Bower M, Stein R, Evans TR, Hedley A, Pert P, Coombes RC (1992) A double-blind study of the efficacy of metronidazole gel in the treatment of malodorous fungating tumours. *European Journal of Cancer* 28A(4–5): 888–9
- Bowler PG, Davies BJ, Jones SA (1999) Microbial involvement in chronic wound malodour. *Journal of Wound Care* 8(5): 216–8
- Bowler PG, Duerden BI, Armstrong DG (2001) Wound microbiology and associated approaches to wound management. *Clinical Microbiology Reviews* 14(2): 244–69
- Clark J (2002) Metronidazole gel in managing malodorous fungating wounds. *British Journal of Nursing* 11(Suppl 6): S54–60
- Collier M (1997) The assessment of patients with malignant fungating wounds—a holistic approach: Part 1. *Nursing Times* 93(44): suppl 1–4
- Collier M (2000) Management of patients with fungating wounds. *Nursing Standard* 15(11): 46–52
- Department of Health (DoH; 2001) *National Service Framework for Diabetes*. DoH, London. Available at http://www.dh.gov.uk/PublicationsAndStatistics/Publications/PublicationsPolicyAndGuidance/PublicationsPAmpGBrowsableDocument/fs/en?CONTENT_ID=4096591&chk=R41ZhQ (accessed 16.08.2005)
- Enoch S, Miller DR, Price PE, Harding K (2004) Early diagnosis is vital in the management of Squamous Cell carcinomas associated with chronic non-healing ulcers: a case series and review of the literature. *International Wound Journal* 1(3): 165–75
- Fiegl M, Kaufmann H, Steger GG (2001) Ulcerative breast cancer: case report and review of management. *The Breast Journal* 7(6): 422–6
- Finlay IG, Bowszyc J, Ramlau C, Gwiedzinski Z (1996) The effect of topical 0.75% metronidazole gel on malodorous cutaneous ulcers. *BJournal of Pain and Symptom Management* 11(3): 158–62
- Goldstein EJ (1994) Selected nonsurgical anaerobic infections: Therapeutic choices and the effective armamentarium. *Clinical Infectious Diseases* 18(suppl 4): S273–9
- Goode ML (2004) Psychological needs of patients when dressing a fungating wound: a literature review. *Journal of Wound Care* 13(9): 380–2
- Hack A (2003) Malodorous wounds – taking the patient's perspective into account. *Journal of Wound Care* 12(8): 319–21
- Haughton W, Young T (1995) Common problems in wound care: Malodorous wounds. *British Journal of Nursing* 4(16): 959–63
- Jones PH, Willis AT, Ferguson IR (1978) Treatment of anaerobically infected pressure sores with topical metronidazole. *Lancet* 1(8057): 213–4
- Kitching M (2004) Patients' perceptions and experiences of larval therapy. *Journal of Wound Care* 13(1): 25–9
- Lipsky BA (2004) A report from the international consensus on diagnosing and treating the infected diabetic foot. *Diabetes Metabolism Research and Reviews* 20(suppl1): S68–77
- Lund-Nielsen B, Muller K, Adamsen L (2005) Malignant wounds in women with breast cancer: feminine and sexual perspectives. *Journal of Clinical Nursing* 14(1): 56–64
- Magnan MA (1996) Psychological considerations for patients with acute wounds. *Critical Care Nursing Clinics of North America* 8(2): 183–93
- Moody M (1998) Metrotop: a topical antimicrobial agent for malodorous wounds. *British Journal of Nursing* 7(5): 286–9
- National Institute for Clinical Excellence (NICE; 2004) *NICE issues clinical guideline on type 2 diabetes – prevention and management of foot problems*. NICE, London. Available at http://www.nice.org.uk/pdf/2004_4_diabetesfootcare.pdf (accessed 16.08.2005)
- Neal K (1991) Treating fungating lesions. *Nursing Times* 87(23): 84–6
- Piggin C (2003) Malodorous fungating wounds: uncertain concepts underlying the management of social isolation. *International Journal of Palliative Nursing* 9(5): 216–21
- Price B (1995) Assessing altered body image. *Journal of Psychiatric and Mental Health Nursing* 2(3): 169–75
- Searle A, Campbell R, Tallon D, Fitzgerald A, Vedhara K (2005) A qualitative approach to understanding the experience of ulceration and healing in the diabetic foot: patient and podiatrist perspectives. *Wounds* 17(1): 16–25
- Silhi N (1998) Diabetes and wound healing. *Journal of Wound Care* 7(1): 47–51
- Sparrow G, Minton M, Rubens RD, Simmons NA, Aubrey C (1980) Metronidazole in smelly tumours. *Lancet* 1(8179): 1185
- Wheat LJ, Allen SD, Henry M, Kernek CB, Siders JA, Kuebler T, et al (1986) Diabetic foot infections: Bacteriologic analysis. *Archives of Internal Medicine* 146(10): 1935–40
- Williams K, Griffiths E (1999) Malodorous wounds: causes and treatment. *Nursing and Residential Care* 1(5): 276–85
- Wilson V (2005) Assessment and management of fungating wounds: a review. *Wound Care* 10(3): Supplement 28–34
- Wolff H, Hansson C (2003) Larval therapy—effective method of ulcer debridement. *Clinical and Experimental Dermatology* 28(2): 134–7