

on the surrounding tissues. Collodion paints or sprays have similar disadvantages. The skin should be as dry as possible prior to application of any dressing and the edges powdered to prevent it from sticking on the sheets. When the dressing is removed, it should be stretched and lifted, not pulled or ripped off the skin. Because of these difficulties, I prefer to manage many of my patients with superficial sacral sores with no

considered a sign that the standard of patient care has deteriorated. No doubt such an attitude results in considerable under reporting of incidents of myiasis in temperate countries.^{1,2}

Obligate myiasis is rarely encountered in temperate regions and normally requires particular management according to the species of fly involved. This article deals with facultative myiasis and illustrates that in supervised patients it is no more a reflection on the standard of care than the development of any other infection.

Three families of flies are commonly involved: the houseflies (Muscidae), the blowflies (Calliphoridae) and the fleshflies (Sarcophagidae). All normally breed in excrement, decaying organic materials and cadavers as well as opportunistically infesting wounds with varying degrees of success. In practice the majority of species found in wounds will be feeding on bacteria, macerated tissue and wound exudate. Normally only the fleshflies and some strains of blowflies attack living tissues.

Do maggots have any clinical value?

Almost all of the fly species involved in myiasis form the first wave of faunal succession invading a cadaver and accelerate the rate of autolysis.³ That maggots similarly erode necrotic tissue from wounds was known from the mid-sixteenth century and surgeons in Napoleon's army recorded that maggots in wounds removed putrefying tissues resulting in improved granulation. Deliberate introduction of maggots into wounds was not performed until the American Civil War but use of non-sterile maggots increased the risks of gangrene and tetanus. The first clinical studies were performed following observations that *Wohlfahrtia* fleshly maggots successfully cleared the wounds of soldiers left lying for hours on First World War battlefields. Paradoxically these men often did not develop infections like osteomyelitis whereas those who received prompt treatment did. By sterilising the eggs of blowflies and then rearing the maggots aseptically, Baer achieved a 90% success rate in treating osteomyelitis at a time when the mortality resulting from open leg fractures was around 75%.⁴ Subsequent work showed that maggots not only enhance healing by physical irritation they also produce enzymes that help to macerate the tissues and substances like ammonium carbonate that were said to promote healing.⁵

Since the advent of antibiotics, maggot therapy has become unfashionable, particularly since it

MYIASIS - THE DEVELOPMENT OF FLY LARVAE IN LIVING ORGANISMS

The possibility that a wound may become infected with microorganisms is regarded as something of a fact of life in the field of wound management. However, the invasion of lesions by larger creatures such as fly maggots is often greeted with surprise, if not horror, and in some circles is

holds a degree of aesthetic unacceptability for patients and carers alike. Nevertheless maggots have shown their worth when infestations succeeded where modern therapy failed.^{6,7,8}

Why do flies attack wounds?

All myiasis flies can breed in a variety of decomposing materials. They have an acute sense of smell and easily detect suitable breeding sites. Consequently odour produced by suppurating or necrotic wounds will prove highly attractive. However, there are differences. The common housefly, *Musca domestica*, has only been recorded from humans in insanitary conditions or a state of neglect⁹ which fits with its normal saprophagous habit and it is not found in wounds receiving regular and adequate treatment. In contrast the blowflies and fleshflies are true opportunists that may attack any wound. The risk of infestation is increased in;

1. elderly or debilitated patients^{1,2}
2. the presence of a pre-existing circulatory disorder which results in a lowering of the temperature of the extremities^{1,2}
3. wounds containing gangrenous, sloughy or necrotic material.
4. wounds covered with dressings saturated with serous fluid, macerated tissue or urine.¹⁰

Additionally the incidence of myiasis in Britain appears to be closely related to spells of warm weather. Up to 1988, the number of cases reported to our Centre averaged one annually, but during two recent warm summers this increased to three cases in 1989 and nine in 1990. Four cases so far reported in 1991 each occurred during hot weather. A similar relationship with temperature was found by Lukin¹. However, the bluebottle blowflies, *Calliphora* spp, and the black blowflies, *Phormia* spp, prefer lower temperatures than the greenbottle blowflies, *Lucilia* spp, and the fleshflies, *Sarcophaga* spp.

All species only visit buildings in search of breeding sites and the internal conditions will affect behaviour.^{3,11} *Lucilia* and *Sarcophaga* prefer sunny areas whereas *Calliphora* and *Phormia* choose shade and will even lay eggs at night. However, just to confuse things recent studies have shown that under some circumstances *Lucilia* will also oviposit at night¹¹.

Can myiasis be avoided?

In practice, like other infections, myiasis cannot be totally prevented. Unless wards are sealed and

air-conditioned or thoroughly fly-screened, flies will always enter during warm weather when windows are opened to allow free flow of air. Fleshflies such as *Sarcophaga* do not lay eggs, instead they deposit small batches of about fifteen active larvae which burrow into tissues and are lost to sight in under an hour. The eggs laid by blowflies hatch in anything from a few minutes to about twelve hours, depending on the time the female has spent seeking an oviposition site. In some cases desperate females may lay active larvae. As a result the chances of larvae being detected are small unless they are caught in the act of migrating to the wound at a dressing change. In most cases maggots are not detected until they have developed to the second or third larval stage. At body temperatures the feeding period of the larvae may be as little as five days following which they leave the wound in search of a place to pupate. In some cases they are only detectable at this stage, especially if the wound is deep and full of slough or partially occluded due to a small aperture.

Treating myiasis

After the initial shock of finding maggots in a wound has subsided a clinical decision is required to evaluate whether the patient has actually benefited from the infestation.⁶⁻⁸ If it is decided that the maggots should be removed, rather than allowed to run their course, then the aim should be to extract them with minimum trauma.

Any maggots lying exposed can be lifted out with forceps followed by flushing the wound with saline. In some cases, where maggots have invaded living tissues, addition of up to 10% chloroform to the saline relaxes the maggots. In some cases under anaesthetic neat chloroform or ether have been used¹². Surgical debridement may be necessary for some species of *Sarcophaga*, which can burrow deeply into tissue sinuses, but in any case where mechanical means are used care should be taken to avoid bursting maggots since some patients may respond anaphylactically to the larval protein.

Since such a variety of flies may be involved, of varying degrees of pathogenicity, it is probably advisable to have all maggots identified at the earliest opportunity.

What of the future?

Concern has been expressed recently that certain dressings, such as hydrocolloids and calcium alginate gels, may attract flies with their noticeable odour. The impermeable nature of

some of these dressings would tend to preclude this possibility. However, in one reported case a wound covered with an alginate dressing that was seen to be intact one day was found to be perforated on the next day with young maggots in the wound. The state of development of these larvae suggested that they were around 20 hours old and they had apparently burrowed through the dressing to the ulcer beneath.

Another aspect of facultative myiasis is that only one properly designed prospective study, on the types of flies and risk factors involved, has been performed in recent years¹. Consequently our knowledge of the condition is extremely limited and contributes to a general unwillingness to reveal quite how frequently myiasis occurs in patients.

References

1. Lukin L.G., Human cutaneous myiasis in Brisbane: a prospective study. *Med. J. Aust.*, 1989, 150, 237.
2. Erzincliglu Y.Z. and Davies S.W., The blue-bottle fly *Calliphora vicina* R-D as a parasite (primary myiasis agent), particularly in small mammals, *Naturalist*, 1984, 109, 31.
3. Smith K.G.V., A manual of forensic entomology. British Museum (Natural History), London and Cornell U.P., 1986, 205.
4. Baer W.S., The treatment of chronic osteomyelitis with the maggot (larva of the blowfly), *J. Bone Joint Surg.*, 1931, 13, 438.
5. Robinson W., Ammonium bicarbonate secreted by surgical maggots stimulates healing in prurulent wounds, *Am. J. Surg.*, 1940, 47, 111.
6. Horn K.L. et al., Maggot therapy for sub-acute mastoiditis. *Arch. Otolaryngol.*, 1976, 102, 377.
7. Bunkins J. et al., Maggot therapy revisited. *West. Med. J.*, 1985, 142, 554.
8. Reames M.K. et al., The use of maggots in wound debridement. *Ann. Plastic Surg.*, 1988, 21, 388.
9. Burgess I. and Davies E.A., Cutaneous myiasis caused by the housefly, *Musca domestica*, *Br. J. Dermatol.*, (in press).
10. Roche S. et al., Cutaneous myiasis in an elderly debilitated patient. *Postgrad. Med. J.*, 1990, 66, 776.
11. Greenberg B., Nocturnal oviposition behaviour of blowflies (Diptera: Calliphoridae), *J. Med. Ent.*, 1990, 27, 807.
12. Alexander J O'D., Arthropods and human skin, Springer-Verlag, New York, 1984, p93.

The Dressings Times is produced by the Surgical Materials Testing Laboratory, (SMTL) Bridgend General Hospital, Quarella Road, Bridgend, Mid Glamorgan. Telephone No. (0656) 652166.