

Myiasis: maggot infestation

Myiasis is a condition in which fly maggots feed off, and develop in, the tissues of living organisms. True myiasis results from flies deliberately laying eggs in or on the tissues. There are two forms of myiasis: obligate, in which it is necessary for the maggots to feed on living tissues, and facultative, where flies opportunistically take advantage of wounds or degenerative necrotic conditions as a site in which to incubate their larvae. In general obligate myiasis of humans is tropical in origin, whereas facultative myiasis can occur anywhere in the world.

The majority of flies that are likely to cause myiasis in humans belong either to the blowfly group, family *Calliphoridae*, or the housefly group, family *Muscidae*. Most species causing facultative myiasis in humans are not pathogenic – which is why some are used in larval therapy, while obligate parasites range from the essentially benign to the potentially lethal.

Infections of wounds and other tissues by micro-organisms are considered an undesirable but inevitable risk in patient management, but infestation by maggots has largely been regarded with horror by carers. In some instances such invasions have been seen as examples of a breakdown in standards of care. One reason for this may be that the low level of reported natural maggot infestations has bred a reluctance to report infestations for fear of reproof.

Intestinal myiasis Some forms of myiasis do not constitute true invasions of the body – for example most cases of intestinal myiasis largely result from ingesting existing maggots with contaminated food. While the low oxygen content of the gut usually kills maggots, most fly larvae have extremely resilient cuticles that are not damaged by digestive enzymes in the human gut, so they pass through intact and are excreted in the stool. Such events are relatively rare in temperate countries and may be the expression of an underlying psychiatric condition or attention seeking behaviour.

Infestation of the urinary tract and the gastrointestinal tract (usually via the anus) can occur and are frequently the result of poor personal hygiene. The species involved normally have aquatic larvae that can live in conditions of high oxygen deficit (Smith, 1989).

Obligate myiasis Although obligate myiasis occurs mainly in the tropics it is now a regular import into temperate countries as more people take exotic holidays, especially those in which travellers trek or stay in rural areas of Africa or South America.

Several fly species have larvae that are unable to

develop other than in viable tissues of a living host, and domestic or wild animals are their normal larval hosts. Most, such as the flesh flies of the genus *Wohlfahrtia* are essentially benign in nature, often entering wounds, and causing only local lesions that resolve spontaneously if the maggots are allowed to develop fully. Others have a high potential for causing pathology. These include the Old World and New World screw worms, *Chrysomya bezziana* and *Cochliomyia hominivorax* that can cause considerable morbidity and even mortality in animals. Generally the Old World flies are less pathogenic unless large numbers infest a wound but the aggressive tissue damage caused by *Cochliomyia* may prove fatal with relatively few maggots present unless they are removed (Oldroyd and Smith, 1973).

Two species are commonly found on travellers as a result of chance exposure. Visitors to western and central Africa may be infested by the tumbu fly, *Cordylobia anthropophaga*, a relative of the bluebottle blowfly that uses rodents, jackals, and monkeys as its normal hosts. This insect usually lays its eggs on plants and sand contaminated with organic materials such as urine, but it will just as readily lay them on clothing or towels with deposits of sweat that have been left in shaded places outdoors. The other species is the South American fly of the family *Cuterebridae*, *Dermatobia hominis*, which uses an intermediary to find its larval hosts. It attaches its eggs to the body of a blood-feeding fly, such as a mosquito, and these subsequently hatch when the insect is feeding.

In both cases the larvae develop in the eggs and emerge when stimulated by mammalian body warmth. They use mouth hooks to grasp the skin to avoid being dislodged, and burrow through the skin to feed on the subcutaneous connective tissue with their rear ends protruding through a small hole in the skin so that they can obtain oxygen.

The boil-like lesion that forms around the entry hole may be uncomfortable, and some people have reported feeling the mouthparts of the maggots scraping away at their tissues, especially *Dermatobia*, which has a large larva. However, neither is normally pathogenic and if allowed to complete development the maggots leave the body in order to pupate (Fig 1). Development of *Cordylobia* larvae takes only eight days but that of *Dermatobia* may last 6–12 weeks. This is rather too much for most victims and their carers, who feel the need to remove the insects for various physical and psychological reasons. Often surgical debridement is used, but because the maggots have large backward pointing spines in their skin (Fig 2) there is a risk of damaging them and releasing larval proteins that may

Ian F. Burgess, MSc, MPhil, BSc, FRES, is director, Insect Research and Development Limited, Fulbourn, Cambridge

Maggot infestation of wounds has in the past been regarded as evidence of poor standards of care. Ian Burgess describes the types of fly maggot infestation found in wounds and explains why this occurs

KEY WORDS

**Maggot infestation
Larval therapy
Wound management**

REFERENCES

- Baer, W.S. (1931)** The treatment of chronic osteomyelitis with the maggot (larva of the blowfly). *Journal of Bone and Joint Surgery*; 13: 438–475.
- Bunkis, J. et al (1985)** Maggot therapy revisited. *Western Journal of Medicine*; 142: 4, 554–556.
- Burgess, I. (1991)** Myiasis: the development of fly larvae in living organisms. *The Dressings Times*; 4: 2, 2–4.
- Burgess, I., Davies, E.A. (1991)** Cutaneous myiasis caused by the housefly. *British Journal of Dermatology*; 125: 4, 377–379.
- Burgess, I., Spraggs, P.D. (1992)** Myiasis due to *Parasarcophaga argyrostoma*: first recorded case in Britain. *Clinical and Experimental Dermatology*; 17: 4, 261–263.
- Evans, P. (2002)** Larvae therapy and venous leg ulcers: reducing the 'yuk factor'. *Journal of Wound Care*; 11: 10, 407–408.

REFERENCES

Hampshire, M. (2000) Larval therapy: world's smallest surgeons with appetite for work. *Nursing Times*; 96: 31, 14–15.

Horn, K.L. et al (1976) Maggot therapy for subacute mastoiditis. *Archives of Otolaryngology*; 102: 6, 377–379.

Lukin, L.G. (1989) Human cutaneous myiasis in Brisbane: a prospective study. *Medical Journal of Australia*; 150: 5, 237–240.

Oldroyd, H., Smith, K.G.V. (1973) Eggs and larvae of flies. In: Smith, K.G.V. (ed) *Insects and Other Arthropods of Medical Importance*. London: British Museum (Natural History).

Ruch, D.M. (1967) Botfly myiasis. *Archives of Dermatology*; 96: 6, 677–680.

Sherman, R.A., Pechter, E.A. (1988) Maggot therapy: a review of the therapeutic application of fly larvae in human medicine, especially in treating osteomyelitis. *Medical and Veterinary Entomology*; 2: 3, 225–230.

Smith, K.G.V. (1989) An introduction to the immature stages of British flies. *Handbooks for the Identification of British Insects*. London: Royal Entomological Society.

Thomas, S. et al (2001) The current status of maggot therapy in wound healing. *British Journal of Nursing*; 10: 22 (Suppl), S5–S12.



Fig 1. If allowed to complete their development, maggots leave the body to pupate. Fig 2. Dermatobia maggot showing large backward pointing spines

cause anaphylactic reactions. The safest method is to occlude the maggots' posterior spiracles (breathing holes) with petroleum jelly or a similar material – pork fat used to be used in the USA (Ruch, 1967) – which causes them to wriggle out in order to avoid suffocation.

Facultative myiasis Nurses are more likely to encounter this than obligate myiasis. It arises when flies opportunistically use wounds or chronic lesions as a site for their larvae. The larvae of most species involved usually develop in cadavers or decaying vegetable matter. There are no reliable figures for incidence of infestation of chronic lesions because many practitioners consider that it must indicate some breakdown of standards of care. However, invasion usually only occurs during hot weather (Burgess, 1991; Lukin, 1989). The flies generally lay their eggs on the outside of dressings and the tiny larvae make their way round or through the dressing to the tissues (Burgess, 1991).

The shock of finding maggots in what was otherwise considered an adequately managed wound has often caused front-line carers to cover up the incident for fear of retribution. Such fears are not without grounds. In the past the author has advised in cases where nurses had been suspended from duty following such an incident, and in other cases where horrified clinicians had wanted to amputate affected digits unnecessarily. However, few people realise flies' extraordinary ability to detect the odours emanating from necrotic conditions coupled with the speed of development of the eggs and larvae once in or on the tissues.

Causes of facultative myiasis The majority of incidents in the UK are due to familiar blowflies in the bluebottle group, *Calliphora* spp and the greenbottle

group, *Lucilia* spp. These larvae are responsible for most degradation of cadavers in exposed places. They are also regularly involved in sheep strike, a form of facultative myiasis in which flies are attracted by skin wounds or fouling of the fleece. The flies have an acute sense of smell and are attracted by various chemicals released from necrotic conditions, especially ammonia.

Other flies that may be involved are flesh flies of the family Sarcophagidae and houseflies and their relatives (family Muscidae) although the latter are mostly attracted to neglected lesions (Burgess and Davies, 1991). In most cases no action is required, other than to collect the mature maggots for disposal as they emerge from the tissue. However, physical removal of flesh flies is occasionally required if the maggots make their way into tissue sinuses (Burgess and Spraggs, 1992)

Life cycle of the maggot Female flies may visit wounds to feed or to lay eggs. They generally lay 50–300 eggs at a time and at skin temperature these hatch around 8–12 hours later. The eggs are about 1.7mm long and the emerging larvae are about the same length but less easy to detect. Once emerged they grow rapidly. Within 24 hours at skin temperature they reach 7–8.5 millimetres long and in only 50–60 hours they are fully-grown. They then stop feeding and migrate from the tissues to seek a dry crevice or soil in which to pupate. In all cases the infestation is self-limiting, determined only by the temperature and the availability of food. Insects in this group normally only take necrotic tissues and slough and it is rare to find them debriding viable tissue.

Historical perspective Their ability to remove degenerate tissue has made maggots a potentially powerful tool in the clinical management of long-term necrotic conditions such as osteomyelitis, and diabetic and venous ulcers that do not readily respond to other therapies. Their beneficial effects have been recognised for at least four centuries, but the limited experiments that attempted to deliberately introduce maggots for wound cleaning before the 20th century mostly resulted in disaster, due to parallel introduction of pathogenic micro-organisms (Sherman and Pechter, 1988).

Interest in larval therapy was revitalised after the First World War. This followed observations of wounded soldiers with open compound fractures who could not be recovered from 'no man's land' for several days, when their injuries had become heavily infested by maggots. At the time, such open wounds usually resulted in 75 per cent mortality from secondary infections, but the wounds of these men were found to

The latest information on
wound care

Update

be lined with healthy pink granulation tissue stimulated by maggot activity.

It was discovered that if maggots were cultivated and transferred to a wound they carried anaerobic bacteria and other pathogens with them. A US surgeon named Baer found that it was easy to sterilise the outside of maggots but that the gut remained contaminated. He developed a method for sterilising fly eggs, using a solution containing mercurous chloride and acidified alcohol (Baer, 1931). This led to a series of successful cases throughout the USA and Canada (Sherman and Pechter, 1988; Baer, 1931).

Effects of maggots on necrotic tissue The effectiveness of maggot activity is poorly understood but the effects appear to result from stimulation of granulation tissue by the maggots' physical activity as they move around to feed on necrotic material. In parallel there is an increase in serous exudate, also stimulated by the irritant effects of maggot activity, that helps to remove micro-organisms. Maggots also digest some bacteria but are reported to secrete enzymes that may assist in breakdown of necrotic tissues and promote wound healing including, allantoin, ammonia, and calcium carbonate (Sherman and Pechter, 1988).

Maggots and wound management Before the introduction of antibiotics, larval therapy was widespread in Europe and North America, with hospitals and pharmaceutical supply houses supplying tens of thousands of maggots weekly. Batches of 200–600 insects were applied to wounds and covered with a dressing for a growth period of 3–5 days. Several species were employed but mostly *Lucilia sericata*, the common greenbottle, *Lucilia illustris*, and *Phormia regina*, a species known as the black blowfly. After the 1940s few clinicians chose to use maggots in favour of the newly discovered antibiotics.

The methodology fell out of favour until the mid 1990s, despite the fact that maggots could often be effective where antibiotic therapy failed (Bunkis et al, 1985; Horn et al, 1976). However, after some publications on the effectiveness of larval therapy (Burgess, 1991; Sherman and Pechter, 1988) a colony of flies was set up in the UK by the Surgical Materials Testing Laboratory, Bridgend. Since 1995 there have been over 40 British publications on larval therapy (Thomas et al, 2001; Hampshire, 2000). It is not only maggots that are doing their work thoroughly, the people working with them are developing new methods for using these useful additions to the therapeutic armoury (Evans, 2002; Hampshire, 2000). ■

Leg Ulcer Forum Glasgow conference

The launch of the Scottish affiliation of the Leg Ulcer Forum (LUF) is to take place at a Walton Conference Suite, Southern General Hospital, Glasgow on 6 June. Topics will include: leg ulcer assessment and pulse oximetry; lymphoedema, introducing a key worker system; and providing a service to the homeless – the team approach. For a programme and more information about LUF, tel: 01480 494842 or e-mail legulcerforum@btopenworld.com. Membership is open to any health care professional with an interest in leg ulcer management and wound care. Membership costs £10 per annum.

New skin cancer awareness scheme

Cancer Research UK is running a national skin cancer campaign – SunSmart. The campaign, launched in March 2003, aims to encourage more people to properly protect themselves and their children from the sun and reduce the risk of skin cancer. Key messages include staying in the shade from 11am to 3pm; make sure you never burn; always cover up; use factor 15+ sunscreen and report any mole changes to your GP. More information about the campaign can be found at www.sunsmart.org.uk from mid-April 2003.

New products

Mepilex Transfer is now available on drug tariff, and through hospital supplies. Mepilex Transfer is a soft silicone exudate transfer dressing, designed for a wide range of large, exuding and difficult-to-dress wounds such as malignant wounds. It is available in two sizes, 15x20cm and 20x50cm. For more information visit www.molnlycke.net or call 0800 731 1876.

Nursing Times wound care awards

There is still time to enter the *Nursing Times* awards. In addition to the Essence of Care in Wound Care, categories also include: original research, innovations in working with people from different ethnic groups and innovations in your specialty. Scholarships will also be awarded. See p71 for the winning entry of the 2002 Essence of Wound Care. For more information call Polly Read-Fleming on 020 7874 0542 and request an entry pack. Also look out for more information on www.nursingtimes.net

Publications

Jacqui Fletcher discusses the need to standardise the methodology used to research chronic wounds in the April issue of *Professional Nurse*. This follows on from a paper published in the March issue that examined how prevalence and incidence of chronic wounds is measured.