The Pennine Acute Hospitals NHS Trust

Guidelines for the use of Sterile Larvae in Wound Management

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1.0 Introduction

1.1 Larval therapy is widely used by healthcare practitioners throughout the United Kingdom for the debridement of non-viable tissue. The benefits of this treatment are well documented and have been widely published as described below. This document is adapted from the guidelines issued by ZooBiotic Ltd and outlines the background to the use of the technique and describes the procedures that should be followed in The Pennine Acute Hospitals NHS Trust when using larval therapy.

1.2 The presence of necrotic or sloughy tissue within a wound delays healing and increases the possibility of infection. Conventional non-surgical methods for debriding wounds tend to be slow and often ineffective involving considerable nursing time and expense. Colonisation or infection of such wounds by antibiotic-resistant bacteria represents an additional problem, forming an important source of cross infection.

1.3 Larvae of the greenbottle fly, Lucilia Sericata, have been shown to rapidly remove devitalised tissue from all types of wounds, irrespective of their underlying aetiology. Sterile larvae have been available in the United Kingdom since 1995, when The Biosurgical Research Unit, part of the Princess of Wales Hospital in Bridgend, reintroduced the technique.

2.0 Types of wounds suitable for Larval therapy

2.1 Larval therapy is suitable for most types of wounds that contain adherent slough or necrotic tissue, or wounds that are clinically infected and not responding to antibiotic therapy. These wounds include:

Leg ulcers
Haematomas
Pressure ulcers
Diabetic foot ulcers
Traumatic wounds
Amputation sites
Dehisced surgical wounds
Some fungating wounds
Infected wounds of all types that have failed to respond to conventional treatments.

2.2 The following wounds are not generally considered to be suitable for larval therapy:

Any wound where the blood supply is insufficient to permit healing to take place.
Dry necrotic wounds
Fistulae
Areas of necrotic tissue close to major blood vessels or nerves
Wounds that connect with the abdominal cavity or any internal organ
Any wound that bleeds easily
Larval therapy should not be applied to patients with clotting disorders, or individuals receiving anticoagulant therapy, unless under constant medical supervision.

3.0 Advantages of Larval therapy

3.1 Larvae are effective against infections caused by a range of microorganisms, including the antibiotic resistant bacterium Methicillin Resistant Staphylococcus Aureus (MRSA). This organism may cause serious wound infections and is a major problem in healthcare facilities throughout the country. The demonstrated ability of larvae to eliminate

MRSA from wounds makes them a valuable tool in the fight against cross infection in hospitals and residential nursing homes**.**

3.2 Compared with conventional therapies, the application of larvae reduces treatment times by weeks or even months. They also reduce or eliminate odour and numerous clinical papers have been published that describe the successful use of larvae, in situations where other treatments have failed or are inappropriate. Several of these studies have reported that the use of larvae has prevented the need for surgery or amputation of toes or limbs.

3.3 Whilst larvae clearly cannot be regarded as the treatment of choice for all types of problematic wounds, they do have a valuable role to play, particularly in situations where conventional treatments are likely to prove ineffective.

4.0 Mode of action

4.1 The range of effects that larvae and their secretions have upon the wound bed, are complex but it is possible to identify three interrelated areas of activity.

4.2 Wound debridement

The first and arguably the most important action of larval secretions is that of wound debridement. Larvae, contrary to popular belief, do not have teeth and therefore cannot actively 'chew away' dead tissue. They feed mainly by a process of extracorporeal digestion. Secreted collagenases, trypsin-like and chymotrypsin-like enzymes have been described, 1-7 which breakdown the necrotic tissue into a semi-liquid form that the creatures can ingest. It has also been reported that larval secretions appear able to destroy unhealthy or abnormal tissue leaving healthy tissue in its place.8

4.3 Anti-microbial activity

The second important action of larvae is their ability to combat infection in wounds. The early literature contains many references to the successful treatment of chronic or acutely infected soft tissue injuries, including those infected with Clostridium welchii (Cl. perfringens), the 'gas bacillus'. Wounds treated with larvae included abscesses, 8 carbuncles, 9 leg ulcers, 10 pressure ulcers, mastoiditis,11 and compound fractures. Larvae were primarily used, however, in the treatment of osteomyelitis, 8-10, 12-18 and although unable to digest or liquefy dead bone (sequestra), they were said to facilitate its separation at the interface with normal bone, leaving behind clean healthy granulation tissue. 8,19

4.4 It is believed that the ability of the larvae to combat wound infection is at least partly due to the antimicrobial nature of their secretions as shown in published laboratory studies, [20-22] but a further and possibly even more important mechanism is the ability of the actively feeding larvae to ingest bacteria and destroy them as they pass through their gut.[18, 23-25] This would explain their ability to eliminate MRSA,[26,27] and Pseudomonas - organisms that have been found to be less susceptible to their external secretions under laboratory conditions. In such situations, however, it is important to ensure that a sufficient number of larvae are present in the wound to exert an antimicrobial effect.

4.5 Growth promoting activity of larval secretions

The third activity associated with larval secretions is their apparent ability to facilitate wound closure. This was first noted by Larrey in 1829, who reported that when larvae developed in wounds sustained in battle, they prevented the development of infection and accelerated healing.[28] This view was shared by Baer,[12] and Fine,[9] who continued to apply larvae even when debridement was complete, to keep the wound clean and promote healing. Scientific support for the reported wound healing properties of larvae has emerged from the work of

Prete[29] who showed that larval secretions stimulate the development of fibroblast cells in culture.

5.0 Side effects and contra-indications to Larval therapy

5.1 Exudate production is often increased during larval therapy. This exudate may be discoloured and have a distinctive odour. This needs to be explained to the patient and colleagues as it may be mistakenly interpreted as signs of infection.

5.2 Sometimes patients complain of increased wound pain during treatment. This most commonly occurs in the case of ischaemic wounds and is thought to result from changes in wound pH. If pain becomes a problem, the larvae should be removed earlier than usual, unless the pain can be controlled by the use of analgesics.

5.3 Because larvae liquefy dead tissue there is sometimes an initial increase in wound odour. This is only temporary and usually resolves after the first dressing change.

5.4 It has been reported that a very small proportion (less than 1%) of wounds dressed with maggots show evidence of bleeding. This is generally limited to slight oozing from small capillaries but in a few instances it has been reported that wounds have bled more profusely, due to erosion of the wall of a small blood vessel. For this reason it is recommended that maggots are not applied in close proximity to major veins unless the patient is under constant medical supervision.

5.5 Larval therapy should not be applied to patients with clotting disorders, or individuals receiving anticoagulant therapy (e.g. Warfarin), unless under constant medical supervision.

5.6 It is recommended that a maximum of five containers of larvae (75-1000 maggots) should be applied at any one time, due to a theoretical possibility of ammonia toxicity to humans.[3°]

5.7 Transient pyrexia may occur in some patients, possibly due to the absorption of pyrogenic material that is released from the cell walls of gram-negative bacteria that are lysed during their passage through the maggots' gut[16].

6.0 A guide to Larval therapy

6.1 Where can larval therapy be provided?

Although the majority of patients are currently treated in hospital, there is no reason why larval therapy should not be provided to patients in their own homes, which would have obvious financial benefits for the NHS. The treatment is now available on FP10, which means that many more patients will experience the benefits of this form of therapy in their own homes without the need for hospitalisation.

6.2 Who should administer the therapy?

Larval therapy should only be undertaken by an individual who has previous practical experience in the management of wounds and understanding of the wound healing process.

6.3 Obtaining informed consent

Candidates for larval therapy should be carefully assessed prior to treatment and informed verbal consent obtained in every instance. It must be carefully explained to each patient that they will have live larvae on their wound for up to five days and they must be happy to accept this procedure. A patient information sheet should also be given to the patient or their

carer prior to the commencement of the therapy to address any further concerns that they may have (see appendix 1). Enlist the help of an interpreter if required.

6.4 Preparation of the wound

Although larvae are effective in the treatment of many different types of wounds, hard necrotic tissue may prove difficult for them to penetrate. In such situations, the use of a hydrogel, hydrocolloid or wet hydrofibre dressing (Aquacel), to rehydrate or soften the dead tissue prior to the application of the larvae will make the therapy more effective. If a hydrogel is used, it is important to ensure that this is removed from the wound before the larvae are applied. It has been shown that maggots are adversely affected by the presence in wounds of hydrogel residues containing propylene glycol as a preservative[31]

6.5 Ordering sterile larvae

Sterile larvae can be ordered during working hours from Monday to Friday, by following the process outlined below:

- Complete non-stock requisition form enclosing the following details:
- Ensure that the patients name is clearly stated on the requisition form
- Include the name and address of the ward/department and hospital site that delivery is to be made
- Enclose details of size and location of wound
- Enclose details of number of pots or size of BioFOAM Dressing required (See appendix 2 and 3)
- Specify size and type of net dressing required if not using BioFOAM Dressing
- Mark up as URGENT in delivery date space and specify the date that the larvae are required
- Fax requisition form to supplies department 78611 or 78609
- Ring supplies department and ensure that someone is dealing with the order and make a note of the persons name in case of queries later.

6.6 Orders must be placed by 12.00 noon and will be dispatched by courier for delivery the following day. Orders received after this time will be scheduled for delivery on the next convenient date for the person applying the maggots. Deliveries are made Monday to Saturday with no delivery on Sunday.

6.7 To cancel an order, contact ZooBiotic Ltd on 0845 2301810, before 12 noon on day before delivery. All cancellations received after this time must be paid for.

6.8 Deliveries should be made by 12 noon. If however you have not received your delivery by this time, then please contact 0845 2301810 to inform ZooBiotic.

6.9 Larvae are available in two forms. The ‘free range’ variety, LarvE pack, which are allowed to roam freely over the wound to seek out areas of slough or necrotic tissue and the LarvE BioFOAM pack (replacing larvE bags). The larvae are enclosed or contained along with foam chips in small fabric bags, which are placed directly upon the wound surface. Larvae contained in this way cannot wander over the wound or find their way into sinuses or body cavities and this presentation does enable them to be used in some of the situations where ‘free-range’ larvae may be contra-indicated.

6.10 Despite the practical and aesthetic advantages of the BioFOAM dressing, free-range maggots should still be regarded as the treatment of choice where cavities or areas of undermining are present.

6.11 Frequency of dressing changes

It is generally recommended that larvae should be left on a wound for 3-5 days, because under ideal conditions they will be fully grown by this time. Sometimes however, if their growth rate is reduced, it may be appropriate to leave them an additional day.

6.12 When the larvae are removed, the wound should be reassessed. At this point more larvae may be applied if required, or if the wound is fully debrided, the treatment may be changed and a more conventional dressing applied.

6.13 Materials required for a larvae dressing

The materials required to perform a larvae dressing will be determined by the size and location of the wound but for a simple dressing the following items will generally suffice:

6.14 Provided by Zoobiotic

Larvae pack containing one or more pots/bags of sterile larvae
A tube of sterile saline
A single net dressing, bag, boot or sleeve (as stated on the order for free-range larvae)
2-3 10x10cm Granuflex hydrocolloid dressings
A roll of Sleek tape 2.5cmx3cm
A 60g pot of Sudocrem (in the BioFOAM dressing pack only).

6.15 Provided by Trust

A sterile dressing pack or wound cleansing pack
A supply of sterile gauze or non woven swabs
A low-adherent absorbent dressing with perforated plastic facing layer e.g. Melolin, Telfa or Release
Yellow bag
A roll of zinc paste bandage, if patient is allergic to hydrocolloid dressings or surrounding skin very fragile
Pair of sterile scissors
A roll of adhesive tape (e.g. Micropore or equivalent)
An absorbent dressing pad and a lightweight retention bandage where appropriate.

6.16 Number of larvae to be applied

The number of larvae to be applied will be determined by the size and condition of the wound. One container of larvae will generally be sufficient for wounds measuring up to 5cm x 5cm. Larger wounds may require two or more pots to effect debridement. Experience has shown that it is much more cost effective to use large numbers of larvae for one or two treatment cycles than smaller numbers for an extended period. A simple ‘calculator’ that may be used to help determine the number of pots required is available (see appendix 2).

6.17 Application of ‘free-range’ larvae

It is recommended that a dressing system be used that retains the larvae within the wound and prevents them from migrating onto the surrounding skin. The precise nature of the dressing system selected will be determined by the size and location of the area to be treated.

6.18 Cut strips of hydrocolloid dressing and place these around the margin of the wound. If the wound is of limited depth, a double layer of a hydrocolloid dressing may be applied to form a shallow chamber into which the larvae are introduced.

6.19 If a hydrocolloid dressing is contraindicated or not acceptable to the patient, for example, if there is a known allergy, or fragile surrounding skin, the skin surrounding the wound may be protected with strips of a bandage impregnated with zinc paste.

6.20 Alternatively, for an extensive wound on the foot, a net boot is available that can be secured to a band of hydrocolloid cut into strips of approximately 5cm wide and applied to the foot above the wound without tension. If hydrocolloid dressing is contraindicated then strips of a bandage impregnated with zinc paste may be used as an alternative. Smaller boots (half-boots) are produced for the treatment of necrotic toes.

6.21 For extensive or circumferential leg ulcers a net sleeve, open at both ends, can be slid into place over the affected area and sealed to a band of hydrocolloid strips as outlined above, above and below the margins of the wound.

6.22 Once the wound has been prepared the larvae can be applied. These are removed from the container in which they are supplied by the addition of a small volume of sterile saline, which is gently agitated to release the larvae from the lid and the walls of the tube. If more than one pot of maggots is to be applied, pour the contents of this first container into the second and agitate as before, repeating this process as many times as necessary.

6.23 If necessary, the sterile net can be cut with sterile scissors so that it is large enough to cover the exposed area of the wound and part of the surrounding hydrocolloid border. The saline containing the larvae is then poured out onto the larvae net. It is recommended that this net is placed upon a sterile gauze swab and pre-moistened with saline to overcome surface tension effects. When the saline containing the larvae is poured out onto the net, the liquid is immediately drawn away through the mesh by the swab, leaving the larvae in a heap on the surface.

6.24 The net retention layer is then inverted over the wound and taped securely to the hydrocolloid sheet using the waterproof adhesive Sleek tape provided. N.B. Sleek tape **should not** be applied directly to the skin due to the risk of tissue damage occurring. This effectively forms an enclosure that prevents the larvae from escaping onto the surrounding skin.

6.25 If a zinc paste bandage is used in place of the hydrocolloid sheet, the nylon mesh is pressed firmly down into the paste and a further layer of bandage applied around the edges to anchor the net in position. The central part of the net must remain un-occluded in order to permit free drainage of exudate and allow the larvae to obtain an adequate supply of oxygen.

6.26 The young hatchlings are quite delicate and need to be kept moist. It is therefore recommended that a swab moistened (but not saturated) with saline be applied over the outside of the net. An absorbent dressing pad with a perforated plastic film wound contact layer is then applied and held in place with tape or a bandage as appropriate (loose fitting stockinette may be preferable in cases of severe peripheral vascular disease). Occlusive dressings or film dressings **should not** be used, as these will cause the larvae to suffocate. Any unused larvae should be disposed of and not retained for further use, as they can no longer be considered sterile. The dressing should be checked on a daily basis as required to ensure the larvae are still active and replace saline moistened gauze swabs if drying out has occurred.

6.27 Application of BioFOAM dressing

Before applying the BioFOAM dressing to the wound, it is advisable to protect the surrounding skin from excoriation with Sudocrem or zinc paste bandage. Apply BioFOAM dressing/s to cover the wound surface and cover with a suitable absorbent pad held in place with tape or bandage as appropriate (or loose fitting stockinette in cases of severe peripheral vascular disease). The dressing should be checked on a daily basis as required and the outer absorbent pad changed as required. Whilst performing daily checks, the BioFOAM

dressing may be moved around the wound if required. Occlusive dressings or film dressings **should not** be used, as these will cause the larvae to suffocate.

6.28 Because larvae in bags are slower to grow than the free-range variety they may be left in place for 4-5 days after which time they should be removed and disposed of as described below.

6.29 Removal of larvae from a wound

Removal of larvae is a simple process. Depending upon the location and size of the wound, the net retention dressing should be removed with or without the hydrocolloid frame, and the larvae gently removed with a gloved hand or a pair of forceps. Any larvae that have found their way into the depths of a wound will generally come to the surface if the wound is irrigated with a stream of sterile water or saline.

6.30 Larvae will not pupate or turn into flies within a wound and they cannot multiply or 'breed'. If further larvae are to be applied, it does not matter if a few small individuals are missed, as these will easily be retrieved at the time of the next dressing change by which time they will be fully grown.

6.31 The disposal of larvae removed from wounds

The larvae supplied are sterile up to the time that they are introduced into the wound. After they have been in contact with tissue or body fluid they should be regarded as potentially contaminated, and disposed of as any other type of dressing residue or clinical waste in accordance with the local control of infection policy. This normally involves double-bagging them in clinical waste bags, which should be sealed and sent for destruction in the usual way.

6.32 On the death of a patient

If a patient dies during larval therapy, the larvae should be removed prior to transfer to the mortuary and disposed of as described above.

7.0 Further information

7.1 Further information on any aspect of larval therapy may be obtained from The Tissue Viability Team or www.zoobiotic.com

8.0 Supporting References

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Appendix 1.

A Guide To Larval Therapy. (For Patients, Carers and Clinicians).

To view click on link below.

www.zoobiotic.co.uk/patients-guide.htm

Appendix 2

LarvE® Calculator

The LarvE® Calculator Indicates The Recommended Number Of Pots Of Sterile Maggots Required Per Application To Achieve Rapid Debridement Of Sloughy/Infected Wounds. To View LarvE Calculator Click On Link Below:

www.zoobiotic.co.uk/larve-calculator.htm

Although these recommendations are based on extensive clinical experience with the technique, the final decision on the number of pots to be applied must remain the responsibility of the practitioner providing the treatment.

Appendix 3

BioFOAM Dressing Size Guide