Clinical Guidelines for the use of Larval Therapy in Burn Wounds

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Contents

Background

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

Larvae of the green bottle fly, ***Lucilia sericata***, have been shown to rapidly remove necrotic tissue from all types of wounds, irrespective of their underlying aetiology.

Advantages of Larval Therapy

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 care settings.

Compared with conventional therapies, the application of larvae reduces treatment times by week's 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 larval therapy has prevented the need for surgery or amputation of toes or limbs.

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

Often there are patients who physiologically are unfit to undergo surgical debridement, these patients could be having their wound debrided by larval therapy whilst they are being optimised for theatre.

Mode of Action

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

1. Wound debridement.

The first and arguably the most important action of larval secretions is that of wound debridement.
Larvae, contrary to widespread belief, do not have teeth and therefore cannot actively 'chew away' dead tissue. They feed by a process of extracorporeal digestion. Secreted collagenases and trypsin-like and chymotrypsin-like enzymes have been described (Baer 1929; Casu et al 1994).
These enzymes break down the necrotic tissue into a semi-liquid form that the creatures can ingest. It has been reported that larval secretions appear able

to destroy unhealthy or abnormal tissue leaving healthy tissue in its place (Weil et al 1933)

2. 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 welchi (CL. perfringens)* the 'gas bacillus.'

Wounds treated with larvae included abscesses, carbuncles, leg ulcers, pressure ulcers, mastoditis, and compound fractures (Fine and Alexander 1934; Weil et al 1933; Ferguson and McLaughlin 1935; Horn et al 1976). Larvae were primarily used, however, in the treatment of osteomyelitis and although unable to digest or liquefy dead bone (sequestra) they were said to facilitate its interface with normal bone, leaving behind clean healthy granulation tissue (Weil et al 1933; Ferguson and McLaughlin 1935; Baer 1931; Livingstone and Prince 1932; Pomeranz 1932).

3. 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 (1829) who reported that when larvae developed in wounds sustained in battle, they prevented the development of infection and accelerated healing. Baer (1931) and Fine and Alexander (1934) have supported this view and continued to apply larvae even when debridement was complete to keep the wound clean to promote healing. Scientific support for the reported wound-healing properties of larvae has emerged from the work of Prete (1997) who showed that larval secretions stimulate the development of fibroblasts cells in culture.

Indications

- Adult or paediatric patients with a deep burn wound
- Necrotic or sloughy wounds (including leg ulcers, pressure sores, burns, ulcerated areas on the feet of diabetic patients)
- Patient unsuitable for surgery.
- Wounds unsuitable for surgical debridement.
- When previous treatment of the wound has been ineffective.

Contra-indications to Larval Therapy / Potential Side Effects

Sometimes patients complain of increased wound pain during treatment. This most commonly occurs in the case of ischaemic wounds and is thought to result in 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.

Because larval therapy liquefies dead tissue exudate production, odour is often increased during treatment. The exudates may be discoloured and have a distinctive odour. This needs to be explained to the patient and colleagues as it may mistakenly be interpreted as signs of infection.

- Treatment is unacceptable to the patient.

- Patient unable or unwilling to give informed consent.
- Large areas of sloughy or necrotic tissue (i.e. larger than 20 x 30cm)
- Wounds that tend to bleed easily.
- Wounds close to any large blood vessels.
- Facial wounds.
- Patients on Warfarin therapy

Who Should Apply Larval Therapy?
An individual who has previous practical experience in the management of wounds and a thorough understanding of the wound healing process should only undertake larval application. Prior training in practical aspects of the technique is essential to ensure that appropriate standards of care are maintained. The person applying the larval therapy needs to be responsible for the co-ordination of the whole procedure.

Requirements Prior to Ordering the Larvae
Candidates for larval therapy should be carefully assessed prior to treatment and informed consent obtained in every instance. During this process, terms such as 'biosurgery' or 'larval therapy' should be avoided. It must be carefully explained to each patient that they will have live larvae on their wound for up to three days and they must be happy to accept this procedure. Assess the size of the area to be treated and the condition of the wound this will determine the number of larvae to be applied. Experience has shown that it is more cost effective to use large numbers for one or two treatment cycles than smaller numbers over an extended period.

Although larvae are effective in the treatment of many diverse types of wounds, hard necrotic tissue may prove difficult for them to penetrate. In such situations, the use of a hydrogel or hydrocolloid dressing to rehydrate or soften the dead tissue prior to the application of the larvae is recommended. Do not apply to a wound that has had Silver Sulphadiazine or another antimicrobial on.

Larvae are applied in tea bags or 'BioBags™' in which the larvae are enclosed or contained in small fabric bags that are placed directly upon the wound surface. These bags are made from a heat-sealed polyester net and contain a sterile polyvinyl alcohol foam spacer which enables free movement of the larvae in the bag. The pores of the net allow the larvae;s mandibles to have direct contact with the wound bed.

Order the larvae prior to the planned procedure and co-ordinate, as necessary. All larvae must be prescribed on the drug kardex and ordered via pharmacy. Measure the wound size, (length and width and depth if required) to determine what size and how many bags are required.

Storing Sterile Larvae
Larvae should be used on the day of delivery and must be applied within 8 hours of receipt to ensure the Larvae are in an optimum condition. Until this time they should be stored in the insulated box, which contains a cool pack,

until required for use. They should be kept at a temperature of below 25 ° C and should **NOT** be put into a refrigerator.

References

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Appendix 1

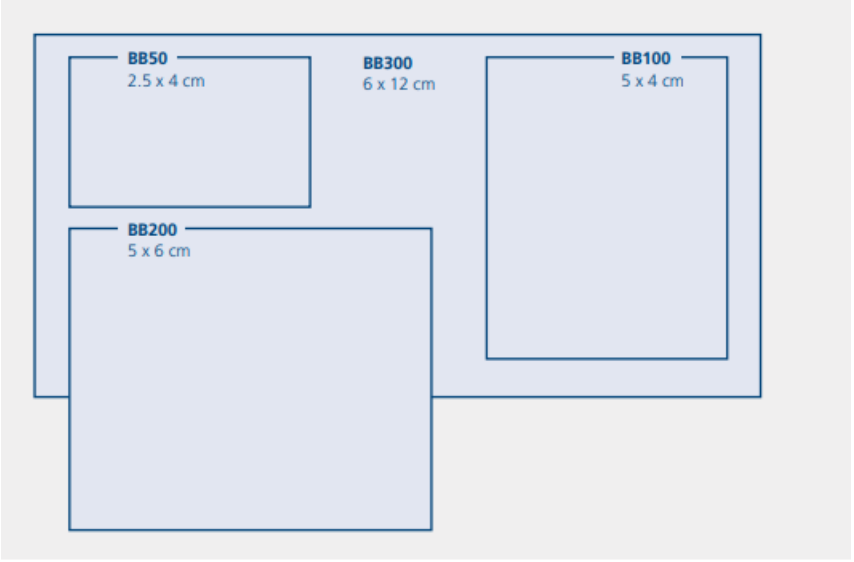
Application of BIOBAG Larvae

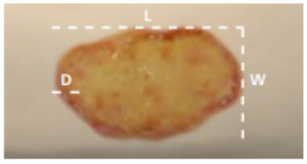
Application Directions	Rationale
Explain the procedure and potential complications of having larval therapy, the use of live larvae, to the patient. Ask whether they want to have the word larvae or maggot used. Give written information regarding larval therapy.	To inform the patient of the procedure and gain informed consent.
Complete wound assessment and document. All patients receiving larval therapy should have an appropriate plan of care. Ensure LOT number is documented on yellow card provided.	To enable evaluation of treatment and to promote continuity of patient care.
Ensure the patient is positioned comfortably and in a suitable position for the dressing to be applied and that they fully understand all aspects of the treatment.	To reassure the patient and provide an opportunity to address any concerns that they might have. To enable smooth running of the procedure.
Prepare a dressing area containing the following items: • Larvae BIOBAG • A sterile dressing pack. • A pair of sterile gloves. • A roll of waterproof adhesive tape (sleek) 2.5cm wide • Gauze swabs. • A roll of adhesive tape. • A lightweight retention bandage if appropriate. • Barrier Cream	The dressings selected will be determined by the size and location of the area to be treated but for a simple procedure, these items will suffice.
If applying BioBags to the wound, it may be advisable to protect the surrounding skin from excoriation with a propriety skin protection agent or cover it with a barrier cream.	To protect intact skin from larval enzymes.
A sufficient number of Biobags to cover the wound surface are then removed from their transit containers and placed in position. You need to overlap the wound edges but do NOT overlap the biobags in the wound. The bags are then covered with moist gauze and dry gauze held in place with tape or a bandage as appropriate	To ensure correct application and promote larval growth.

Because larvae may be left in place for 4-5 days after which time they should be removed and disposed of in accordance with local infection control policy / guidelines on disposal of waste. Biobags should NOT be moved around the wound.	This will ensure the larvae perform optimally.

Frequency of Dressing Change	
Larvae need changing roughly every 4 days. So depending on date of application it may be they are used on a 3 and a 4-day cycle. Ideally need to check on day 3 if the wound needs another cycle.	Depends on date of application as no delivery on Sunday. Checking on day 3 potentially stops larvae being ordered inappropriately
Check outer bandages, absorbent padding and gauze on a daily basis and change if they become excessively wet or malodorous.	This maintains comfort and dignity of the patient and prevents the outer. dressing from becoming saturated, which could adversely affect Larval growth.
Reapply moistened absorbent padding each day or twice daily if necessary. If patient is on a low air loss mattress check that dressing does not dry out, recommended at least twice per day.	To prevent the Larvae from dehydrating, additionally application of moisture in this manner avoids the potential of drowning the larvae.
If pain becomes a problem, it may be necessary to remove them earlier, if increasing the patient's analgesia is not an option.	To maintain patient comfort.
Removal	
Inform the patient of the procedure, position the patient and yourself comfortably and ensure all equipment is to hand.	To gain informed consent and ensure smooth running of the procedure.
Gently remove the outer bandage or dressing, remove the biobag and double bag directly into clinical waste, along with other waste.	To prevent cross infection and contamination. To comply with local guidelines and policies on clinical waste disposal.
When the Biobag has been removed, reassess the wound to see if any further larval therapy is required or whether a change to conventional treatment is indicated.	If full debridement has been facilitated larvae are normally no longer required.
When larvae have been in contact with bodily tissue and / or fluids they must be regarded as potentially contaminated waste and disposed of in accordance with local trust infection control policies.	This normally involves placing them in clinical waste bags / containers that should be sealed and sent for destruction in accordance with local infection control policy on disposal of waste.
Expected Outcome	
Burn wound will be debrided	

Appendix 2 – Bag Sizes





Choosing the right size

- Measure the length, width and depth of the wound
- Cover the wound bed and overlap onto the wound margins
- BioBag® must have direct physical contact with the area to be treated

Appendix 3 - Burn Pathway