

SUSHRUTA: THE PIONEER OF MAGGOT THERAPY- A REVIEW

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ABSTRACT

Maggot therapy is a type of bio- therapy involving the introduction of live, disinfected maggots (fly larvae) into the non healing skin and soft tissue wound for the purpose of cleaning out the necrotic tissue within a wound. The mechanism of its action is based on Debridement, disinfection of the wound, stimulation of healing and biofilm inhibition and eradication. Though the contemporary science has moved further in the application of maggot debridement therapy (MDT), the induction of this had been already done by the Father of surgery Acharya Sushruta. It is need of the hour to conserve this principle and bring it into application in the Ayurvedic practice.

Keywords: Maggot debridement therapy, Acharya Sushruta, Debridement, Disinfection

INTRODUCTION

Ayurveda the oldest medical science has always provided fascinating concepts related to the application of existing components in the world. Sticking on the strong view that all the factors in the *lokha* itself is present in the *Purusha*, even the treatment modalities have shown wide application of all components present in the world be it *sthavara dravya* or *jangama dravyas*. In this view it is interesting to note the innate knowledge the Acharyas with regard to the *chikitsa* of various conditions.

Sushruta in the context of *kaphaja arbuda*¹ described about a treatment modality which

involves the application of maggots; now this is widely practiced in the contemporary science. The main aim of this therapy as told by Sushruta and contemporary science is the same- 'the healing of wound'. Whatever be the basis it is proved that the live maggot therapy has striking effects in the management of certain conditions.

Maggot therapy (sometimes called larval therapy) is the application of live fly larvae to wounds in order to aid in wound debridement (cleaning), disinfection and/or healing. Maggots are fly larvae or immature flies. In maggot debridement therapy (MDT) germ free

larvae of therapeutic fly species are used based on the principle that they feed on the dead tissues. Observations have indicated that maggots have the ability to debride wound bed, provide anti microbial activity and stimulate wound healing. Maggots have been known for centuries for their healing activity. But it was soon replaced by the new antibiotics and surgical techniques. But now when antibiotics, surgery and modern wound care failed to control the wound, maggot therapy is again gaining attention. Since it is a safe and effective treatment tool. In this regard it is necessary to understand the mode of action and also the conditions in which maggot therapy can be made use for.

Aims and objectives

- ✓ To review the current evidence on mechanism of action and clinical application of maggot therapy.
- ✓ To review the concept of Maggot therapy as mentioned in Sushruta samhitha.

Maggot varieties used in the MDT-

Not all species of flies are safe and effective. The flies used most often for the purpose of maggot therapy *Lucilia sericata* (green bottle fly) and *Protophormia terraenovae* (northern blowfly)

Mechanisms of maggot debridement therapy-

Debridement -Scientists first postulated that the debriding action of maggots was due to their mechanical wriggling². Maggots use a pair of mandibles/hooks for movement and attachment, and it was believed that the probing from the hooks may facilitate wound de-

bridement. Recently, three proteolytic enzyme classes have been identified in the maggot excretions/ secretions (ES).³These enzymes effectively degrade extracellular matrix components, including laminin and fibronectin. The ES could thus assist in the digestion of the wound matrix, leading to effective debridement

Disinfection- The presence of antibacterial substances has long been identified in maggot ES. Thus, ES has an inhibitory effect on Gram-positive and Gram-negative bacteria, including methicillin-sensitive *Staphylococcus aureus*, methicillin-resistant *S aureus* (MRSA), *Escherichia coli* and *Pseudomonas aeruginosa*⁴. This activity of the ES was thermally stable and protease-resistant. Using ultra-filtration, the latter study identified two fractions with inhibitory effects on *S aureus* and MRSA. It was also believed that ammonia excreted by maggots increases wound pH, thereby creating an unfavorable environment for bacterial growth.⁵According to another hypothesis, maggots ingest bacteria and kill them within their alimentary tract. Mumcuoglu *et al*⁶ investigated the fate of *E coli* after ingestion by *L sericata*. It transpired that the proximal alimentary canal was more heavily infested, with 67% of the throat harbouring live bacteria. The figures dropped dramatically as the bacteria moved distally along their alimentary canal. Only 18% of the posterior hindgut was found to contain live bacteria.

Enhancement of wound healing -It was believed that the enhancement in tissue growth was due to an increase in fibroblast proliferation brought about by the ES.⁷ Horobin *et al*⁸ demonstrated that the ES altered fibroblast

adhesions to collagen and fibronectin, and it was subsequently shown that it increased the migration (but not proliferation) of fibroblasts. This was attributed mainly to the action of serine and metallo proteinases. These investigators then developed a three-dimensional model to better simulate a human wound.⁹ Their results were consistent with the previous studies and supported by later investigators. An up-regulation of tyrosine phosphorylation was also detected, which possibly enhanced the motility of the fibroblasts.¹⁰ Others have postulated that maggots secreted cytokines, which help wound healing. High levels of gamma-interferon and interleukin-10 (IL-10) were found in the ES, but as to whether these cytokines are responsible for increasing granulation requires further investigation.⁷

Clinical application of maggot therapy

- Non-healing necrotic skin and soft tissue wounds
- Pressure ulcers
- Venous stasis ulcers
- Neuropathic foot ulcers
- Non-healing traumatic or post-surgical wounds

Contra-indications

Dry wounds are a relative contra-indication as maggots require a moist environment. The use of maggots should also be avoided in open wounds of body cavities or wounds in close proximity to large blood vessels so as to facilitate the removal of the larvae.¹¹ Also, maggots should not be used in patients who are allergic to eggs, soybeans, or fly larvae.¹²

Sushruta's view on maggot therapy-

निष्पावापेण्याककुलत्थकल्कैमोसप्रगाढैदोधिमस्तु
युक्तैः |

लेपं विदध्यात् कृमयो यथाऽत्र

मूच्छन्ते मुञ्चन्त्यथ माक्षिकाश्च ||

अल्पावाशेषे कृमिभाक्षिते च

लिखेत्ततोऽग्निं विदधीत पश्चात् |

यदल्पमूल त्रपुतामसीसपट्टैः समावेष्ट्य तदायसैवो ||

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Nispava, *pinyaka* and paste of *kulattha* added with *mamsa* and *dadhi mastu* should be applied on the *kaphaja arbuda*. This facilitates the growth of the *krimi* due to swarming of the flies. When only a small remnant remain after the worms have eaten, the area should be scraped and burnt by fire or if the base is small it can be kept encircled with thin sheets of tin, copper, lead or iron.¹³

Discussion on Sushruta's view-

Before going into the discussion of *chikitsa*, understanding the concept of *Arbuda* is essential, then one can understand the rationale behind Sushruta advocating maggot therapy in case of *kaphaja arbuda*.

In *Arbuda* the main *dooshya* is *mamsa*. *Kaphaja arbuda* is said to have the same features as that of *kaphaja granthi*. The *gunas* of *kapha* and that of *mamsa* both favors conducive atmosphere for the *krimis*. Nevertheless *Kapha* and *mamsa* having *ashraya ashrayi sambanda* being the prime *dushyas* in *kaphaja arbuda* can also be considered as prime reason for indication of this very unique treatment in case

of *kaphaja arbuda*. The application of *nispavaadi dravyas* are done mainly to attract the flies and create an environment favorable for the growth of the *krimis*. Apart from this it also helps in selection of the right kind of flies, because not all fly larvae have affinity to the diseased tissues, this is achieved by the application of *mamsa*, to the affected area due to which only such flies that crave for the dead tissues are attracted.

The maggots are provided an agreeable atmosphere to live on for a particular period by providing it a diseased area to feed on. When there is a small remnant remaining after the *krimis* have devoured the area, the *krimis* are removed. Then the spot is done *dahana* by *agnikarma* so that there is no chance of the further growth of the *arbuda*. The use of tin, copper, lead and iron for *veshtana* might be because of its *krimihara* activity as mentioned by Acharya Sushruta while mentioning the properties of *trapyadi gana*. Even in MDT, dry wounds are a contraindication since moist atmosphere alone can help in the growth of maggots. Acharya Sushruta also has indicated this *chikitsa* only in *Kaphaja Arbuda* and not in *Vata* or *Pittaja*. Thus it is an effective treatment for *Kaphaja arbuda*.

CONCLUSION

Maggot therapy has long been recognized as a safe and effective treatment for wounds. It is associated with three broad actions: debridement, disinfection, and hastened tissue growth. We now know that these actions are the result of a large number of maggot-host interactions, some of them chemical and some physical.

Acharya Sushruta was the pioneer in bringing this method of treatment into employment. Being Ayurvedists it is need of the hour to recognize this treatment modality as our own and bring it into practice.

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