Maggot Debridement Therapy: Does it Really Work

Dr. Gregory J. Davenport (C) 2009

Correspondence regarding this paper can be directed to
Dr. Gregory Davenport at gjd@gregdavenport.com

Abstract

Studies have shown that maggot debridement therapy (MDT) does help in wound debridement. However, most providers are squeamish about the concept and unaware of how it actually works. Has medicine evolved enough to consider this type of non-conventional therapy that some feel is no different then blood letting of days past?

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Primary care providers must be well versed in a wide range of medical conditions to include proper management of chronic wounds and diabetic ulcers. Caring for these wounds revolves around metabolic assessment, glucose control, assessing vascular status, debridement, and treatment of any infection. If only it was that simple. These ulcers are very difficult to treat, time consuming, costly, and notorious for bad outcomes. In fact, "nonhealing diabetic foot ulcers account for 25-50% of all diabetic hospital admissions, and most of the 60,000-70,000 yearly amputations in the U.S." (Sherman, 2003, p. 446). According to Sherman (2003) 15% of diabetics will develop at least one foot ulcer in their lifetime. Perhaps this is why the medical community is looking at better methods for managing these poorly healing wounds. One treatment under consideration is Maggot debridement therapy (MDT). MDT is the medical use of live maggots (fly larvae) for cleaning non-healing wounds (Bter Foundation, n.d.). The purpose of this paper is to review literature on maggot debridement therapy and discuss the pros and cons of its use when treating chronic wounds and diabetic ulcers.

Historical Observations

No one knows when maggot debridement therapy actually began. According to Fleischmann, Grassberger, and Sherman (2004) "Australian Aborigines used maggots to clean wounds for thousands of years." Were they the first? "These larvae are, indeed, greedy only after putrefying substances, and never touch the parts which are endowed with life" (Larrey, 1832). Dr. Dominic Larrey made his observation during the French invasion of Syria (1798 to 1801) and his words may have been the first recorded that recognized the benefits of maggots and wound debridement. During the American Civil War (1861-1865) Dr. John Zacharias noticed that maggots cleaned a wound better then conventional treatments and started using them to remove decaying tissue from patients with gangrene (Fleischmann, Grassberger, & Sherman, 2004).

In 1917, while speaking before the Clinical Congress of Surgeons of North America, Dr. George Crile stated, "In the wounded who lie out in 'No Man's Land' for two or five or ten days, it has been found that the wounds that have done best are those that contain

maggots" (Goldstein, 1931). Up to this point, maggot therapy observations were related to wartime injuries and often when other options weren't available.

In the 1920s Dr. William Bear was the first person to study and publish the benefits of MDT (Bter Foundation, n.d.). Dr. Bear, Professor of Orthopedic Surgery at John Hopkins University, raised disinfected blowfly maggots and created a cage-like dressing to keep them from escaping. The dressings were applied to 98 children suffering from osteomyelitis. Every child observed got better and was home within two months of beginning treatment. It didn't take long for maggot debridement therapy to catch on and by the early 20th century many providers believed it was an effective wound debridement option. In the 1940s, however, new antibiotics and surgical techniques pushed maggot therapy aside and it simply disappeared from the medical cupboard.

How Maggot Therapy Works

Maggots are part of a fly's natural four-cycle life progression. The cycle begins when the female fly lays eggs on decaying meat found on carcasses, trash, and wounds. Within 12 to 24 hours the eggs will hatch into maggots that begin feeding on the putrid tissue. In about one week the maggots transform to pupae and eventually an adult fly (two to three weeks later). The green blowfly maggot (Phaenicia sericata), selected by Dr. Baer, is the maggot of choice (Bter Foundation, n.d.). These maggots prefer necrotic tissue and rarely feed on healthy flesh.

According to Monarch Labs (2005) (the U.S. manufacturer of medical maggots), "Debridement results partly from the Medical Maggots proteolytic digestive enzymes liquifying the necrotic tissue and partly from the physical action of the mouth hooks on the tissue, which pierce and tear the necrotic tissue, allowing the digestive enzymes to reach the depths of the necrotic tissue". In other words, maggots clean and disinfect wounds and stimulate the healing process (Nigam, Bexfield, Thomas, & Ratcliffe, 2006). Studies have also shown that MDT is more effective when treating Gram-positive bacteria (ex: Staphylococcus aureus) than Gram-negative bacteria (ex: Pseudomonas aeruginosa) (Van

Der Plas et al., 2008). When using maggot therapy for Gram-negative bacteria, Van Der Plas et al. (2008) stated that more maggots are necessary to achieve wound healing.

Maggot Therapy Rebirth

Since 1990 several studies have looked at the benefits of maggot therapy. Perhaps the most well known was the first, conducted in 1990 by the Long Beach California Veteran Affairs Medical Center (VAMC) and the University of California (UC). The study looked at the effectiveness of maggot debridement therapy in the treatment of poor healing wounds (University Of California, 1996). The team focused on answering three questions. "Is maggot therapy still useful today; should maggot therapy be used as an adjunct to other treatments, not merely as a last resort; and how does maggot therapy compare to other treatment at our disposal?"(Bter Foundation, n.d.)

The VAMC and UC five-year (1990 TO 1995) randomized study evaluated 143 patients with poorly healing wounds. The list included diabetic ulcers, pressure ulcers, and chronic wounds (venous stasis, traumatic, and post surgical wounds)(Sherman, 2003). Patients in need of urgent debridement and those with osteomylitis and deteriorating infections were almost always excluded (Sherman & Shimoda, 2004).

Patients who entered the study were either treated with conventional therapy, MDT, or conventional therapy followed by MDT. The treatment took place in a hospital setting and used disinfected larvae. Using a cage like dressing, the larvae were placed directly on the wound (five to eight per square inch) for 48 to 72 hours one to two times a week. Patients were evaluated weekly for eight weeks or until hospital discharge. The primary outcome measures were based on changes in necrotic tissue, granulation tissue, and surface area and how much time it took for the wound to heal (Sherman, 2003). The study "demonstrated that maggot therapy was more effective and efficient at debriding

(cleaning) many types of infected and gangrenous wounds than the commonly prescribed treatments in the control groups"(University Of California, 1996).

In December 2002 an article appeared in the Clinical Infectious Disease Journal (CID) favoring MDT. The article discussed the benefits of maggot therapy on eleven patients with conditions like osteomyelitis (five patients), gangrene (two patients), soft tissue infection (three patients), and chronic ulcers (one patient)(Jukema et al. 2002). During this study 3 to 10 maggot dressings were applied to each patient between 11 and 34 days. Unlike the VAMC and UC study, this study looked at using maggot debridement with osteomyelitis and believed the treatment "helped prevent the need for disabling amputations" (Jukema et al. 2002, p. 1570). All eleven patients had full recoveries.

Between June 2004 and May 2007 another randomized study of maggot debridement therapy was conducted on 267 subjects. The University of York, University of Warwick, and the University of Leeds conducted the study (European study). Patients selected had venous or mixed venous and arterial leg ulcers with slough or necrotic tissue covering at least 25% of the wound (Dumville et al., 2009). The study excluded patients that were pregnant, lactating, anti-coagulated, allergic to hydrogel, and those with edematous legs (Dumville et al., 2009). Participants were treated with loose larvae, bagged larvae, or hydrogel. All larvae were sterile and only the amount advised by the manufacturer was placed on each wound. Larvae were left on a wound for a one-time 72 to 96 hour debridement. If further larvae treatment was felt necessary, hydrogel was used while more were ordered. The medium debridement time was between 14 and 28 days. Nurses, trained in wound care, evaluated patient progress for up to 12 months. Outcome measurement was based on how long it took for the ulcer to completely heal (Dumville et al., 2009).

According to the European study, MDT provided a quick debridement technique. Soares et al. (2009) went on to state, however, "a relatively quick reappearance of necrotic tissue was reported by previous users of larval therapy, suggesting that any positive effects in health related quality of life associated with larval therapy may be short lived." The study

concluded that there was “no evidence that a phase of treatment with loose or bagged larvae reduces the time to healing of leg ulcers compared with hydrogel” (Dumville et al., 2009).

Maggot Therapy Conflict

How is it that most studies support maggot debridement therapy while the European study downplays its effectiveness? Most studies were randomized or based on clinical outcome and used an ample supply of patients. Disinfected or sterile larvae were used and wound healing determined the outcome. There were differences, however. The patients in the first two examples were hospitalized and closely observed by physicians and nursing staff during most of their treatment. The European study was done through wound clinics and managed by nurses who decided if further larvae treatment was needed. The VAMC study applied new larvae every 48 to 72 hours up to twice a week for up to eight weeks. The European group applied larvae for 72 to 96 hour for a medium total time of 14 to 28 days. If further larvae were felt necessary, after each application, it had to be ordered creating a delay in the MDT. The European study followed patients for 12 months, much longer then the others.

One argument presented in the European study against using MDT was that “larval therapy was associated with increased levels of pain, and therefore if the time between debridement and reappearance of slough is short then any potential benefits on health related quality of life associated with larval therapy may be cancelled out” (Soares et al., 2009, p. 7). Pain associated with maggot therapy was also mentioned by Jukema et al. (2002) and was associated with 72 to 96 hour old maggots that were 8 to 10 mm in length. The solution was to use maggot filled biobags (tea bag sized) made of porous PVA membrane. “Maggots in biobags are no less active necrophages than are free maggots; they secrete enzymes and absorb wound debris through the permeable bag membrane, but do not cause the painful sensation of biting and crawling larvae directly on the wound” (Jukema et al. 2002, p. 1570). The European study didn’t comment on which patients complained of pain (loose larvae or bagged larvae) and failed to try shorter applications to see if that might alleviate the problem. The European study also analyzed the cost

effectiveness of MDT as compared to hydrogel and found that larval therapy was as cost effective as hydrogel.

Maggot Therapy Cost and Coding

According to Dr. Ronald Sherman, "some insurance companies will pay tens of thousands of dollars for an amputation, probably because it is so common nowadays, but will hesitate or object to paying $100 for a course of maggot therapy" (MSNBC.com, 2008). This trend may have changed in November 2008, however, when "the American Medical Association (AMA), in collaboration with the Centers for Medicare and Medicaid Services (CMS) issued reimbursement coding guidelines for medicinal maggots and maggot therapy" (Eurekalert, 2008). MDT application can now be coded as a nonexcisional debridement (97602) and the supply of maggots coded as 99070. In addition, the provided is allowed to code an office visit and other supplies needed for this treatment.

Conclusion

Perhaps the key boils down to expectations. Is it realistic to believe anything short of managing the underlying cause will cure chronic wounds and diabetic ulcers? Patients with advanced peripheral vascular disease or diabetics will always struggle with chronic wounds and ulcers. It seems once one looks better a second or third one develops. The provider and patient are faced with options and they often revolve around conventional treatment. Once this fails, amputation seems to be the logical progression and that creates a whole other problem for a patient who already has a neurovascular compromise.

In medicine we embrace weight loss, exercise, and healthy living as a treatment option for hypertension and encourage our patients toward that end. If medication is needed, several options are available and the one that best suits our patient is often the one chosen. Maybe it's time we approach chronic wounds and diabetic ulcers in the same way. Encourage proper diet, exercise, and healthy living and use of appropriate medications. If that doesn't

work and the patient develops a chronic wound or ulcer, it only seems logically to consider all options. This especially holds true prior to the finality of cutting off an appendage.

Just because a treatment wasn't manufactured in a laboratory doesn't make it any less effective. Although there is some controversy in the studies considered in this article, all agree that MDT does help with wound debridement. Perhaps it is time to embrace the maggot and consider it as an option before reaching for the knife.

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