



Management of chronic non-healing wound by Hirudotherapy

Arsheed Iqbal^{1*}, Afroza Jan³, M. A. Wajid¹, Sheikh Tariq², Naqib ul islam¹, Kounsar Jan¹

¹RRIUM, Naseem Bagh Faculty of Medicine, ²JLNM Hospital, Department of Plastic Surgery,

³Institute of Asian Medical Science, Zakura, Srinagar, Srinagar, Jammu and Kashmir, India

Received: 04-10-2016 / Revised: 18-12-2016 / Accepted: 14-01-2017 / Published: 27-01-2017

ABSTRACT

A chronic wound is that wound which does not heal in an regular set of stages and in a expected amount of time or wounds that do not heal within three months are often considered chronic.^[1] Chronic wounds often remain in the inflammatory stage for long time.^{[2][3]} and some never heal or may take years together . Chronic wound patients most often report pain as dominant in their lives.^[4] It has been observed that Persistent pain is the main problem for patients with chronic ulcers.^[8] Many wounds shows no challenge to the body's innate ability to heal; some wounds, however, may not heal easily either because of the severity of the wounds themselves or because of the poor state of health of the individual.

Keywords;-Wound, Hirudotherapy, chronic, healing, Epidermis.

INTRODUCTION

Wound is a sore on the skin or a mucous membrane with disintegration of tissue. An erosion or Wound can result in complete loss of the epidermis and most often portions of the dermis and even subcutaneous fat. A wound that appears on the skin is often visible as an inflamed tissue with an area of reddened skin. Wound can also be caused due to restricted movements or complete lack of mobility, which causes constant or prolonged pressure on the tissues. This stress in the blood circulation is transformed to a skin wound, commonly known as bedsores or decubitus ulcers.^[9] Patients may feel pain on the skin around the wound, and fluid may ooze from the wound. In some cases wound can bleed and, rarely patients experience fever. Ulcers develop in stages. Chronic ulcer symptoms usually include increasing pain, friable granulation tissue, foul odour, and wound breakdown rather than healing.^[10] Ulcers may also appear on the cheeks, soft palate, the tongue, and on the inside of the lower lip. These ulcers mostly last from 7 to 14 days and often appears painful.^[11]

OBJECTIVE: The main objective of this study is to provide alternate and inexpensive treatment to cretin dermatological/Surgical problems.

ETIOLOGY:

Beyond poor circulation, neuropathy, and difficulty in moving. Factors that contribute to chronic

wounds include systemic illnesses, age, and repeated trauma. Ailments that may contribute to the formation of chronic wounds include vasculitis, decreased or suppressed immunity, pyoderma gangrenosum, and some diseases that may cause ischemia.^[2] Immune suppression can be caused by illnesses or medical drugs used for long period, for example steroids.^[2] Emotional stress can also negatively affect the healing of a wound, possibly by raising blood pressure and levels of cortisol, which lowers immunity.^[5] One of the predominant factor that may lead to chronic wounds is old age.^[6] Comorbid factors include chronic fibrosis, edema, sickle cell disease, and peripheral artery disease such as by atherosclerosis.^[2] Chronic wounds and ulcers are caused by poor circulation, either through cardiovascular issues or external pressure from a bed or a wheelchair.^[13] In present day time the uncontrolled environmental pollution and contamination including bacterial, viral, fungal infections and cancers have huge influence in chronic wound predisposition. Blood disorders and chronic wounds can result in chronic skin ulcers as well.^[14]

Pathophysiology: In Chronic wound healing the normal process of healing is disrupted at one or more points in the phase of haemostasis, inflammation, proliferation remodeling and may affect only the epidermis and dermis, or tissues all

the way to necrosis.^[7] Since growth factors, cytokines, proteases, and cellular and extracellular elements all play important roles in different stages of the healing process, alteration in one or more of these components could account for the impaired healing observed in chronic wounds.

CLASSIFICATION OF WOUNDS

Wounds are classified by 'stage'.

- Stage 1 wounds are characterized by redness or discoloration, warmth, and swelling or hardness.
- Stage 2 wounds partially penetrate the skin.
- Stage 3 describes full-thickness wounds that do not penetrate the tough white membrane (fascia) separating the skin and fat from the deeper tissues.
- Stage 4 wounds involve damage to muscle or bone and undermining of adjacent tissue. They may also involve the sinus tracts.

The Stages of Wound Healing:-

All wounds heal in three stages:

1. Inflammatory Stage, occurring during the first few days. The wounded area attempts to restore its normal state by constricting blood vessels to control bleeding. Platelets and thromboplastin make a clot. Inflammation (redness, heat, and swelling) also occurs and is a visible indicator of the immune response. White blood cells clean the wound of debris and bacteria.
2. Proliferative Stage, lasting about 3 weeks (or longer, depending on the severity of the wound). Granulation occurs, which means that special cells called fibroblasts make collagen to fill in the wound. New blood vessels form. The wound gradually contracts and is covered by a layer of skin.
3. Maturation and Remodeling Stage, lasting up to 2 years. New collagen forms, changing the shape of the wound and increasing strength of tissue in the area. Scar tissue, however, is only about 80% as strong as the original tissue.

Infection Delaying Wound Infection: The wound may get infected by large number of bacteria (colonization) and will slow the healing process and The difference between contamination and colonization is only the concentration of bacteria present in the wound area. Anaerobic bacteria such as *bacteroides*, *clostridium* and *streptococcus* may be active at deeper levels of the dermis, insulated from the healing influence of oxygen. Anaerobic bacteria are responsible for many devastating

infections resulting in gangrene and are more closely identified with superficial epidermal layers but may also be involved in infective processes and include *staphylococcus epidermis*, *corynebacteria*, *propionibacteria*.

Use of Antibiotics in non-healing wound: In patients with non-healing wound the antibiotics are broadly used to overcome the risk of local infection, systemic involvement and ultimately to save the the patient from septicemia. Approximately four million cases of non-healing wounds are diagnosed annually in Europe and are clinically felt to be given a good antiseptic or antibiotic cover to save them from spreading the infection. Non-healing wound have been considered a negligible problem in society¹⁴. But patients with non-healing wound shows excessive usage of antibiotics. As early as 1998, Tammelin *et al.* reported that 60.1% of all ulcer patients were treated with one antibiotic within a six-month period while as a huge percentage of patients are needed to be put on dual or combined antibiotic therapy.

Microbiology of chronic non healing wound:

Entities like chronic venous insufficiency, arterial insufficiency, and pressure over time, can lead to the reduced respiration capacity of skin injuries, which can lead to non-healing wound. Bacteria will colonize within the wound if the protective barrier of the skin is broken. Therefore, the appearance of a chronic wound depends on several factors. These factors also contribute to the development of infections in the ulcer.¹⁶ There are often multiple types of bacteria observed within a single wound, For example, the flora usually found in cases of venous ulcers of the legs include *Staphylococcus aureus* (90.5%), *Enterococcus faecalis* (71.7%), and *Pseudomonas aeruginosa* (52.2%).¹⁷ The bacterial flora found in a non-healing wound change as the wound ages. Staphylococci and streptococci bacteria are normally found in new wounds, while gram negative mixed flora are often found in older wounds. In addition, different types of ulcers are influenced by different types of bacteria. For example, a clinical infection will develop in 60% of diabetic foot ulcers but only 20% of venous leg ulcers that are colonized by *Staphylococcus aureus* ¹⁸. Between 1.6 and 4.4 species of bacteria are found per wound by conventional culturing methods⁷. However, molecular biological methods suggest that even more species of bacteria are present in the average ulcer.⁸ The number of ulcers with anaerobic bacterial growth is estimated to be between 25% and 82%. The most common anaerobic bacterial species are *Peptostreptococcus* and *Prevotalla*.^{19,20,21}. Recent research has indicated

that the presence of bacterial biofilm contributes to the development of chronic wound. Studies performed by James *et al.* have shown that biofilm is present in 60% of chronic ulcers but only 6% of

acute ulcers.²² This supports the view that biofilm probably plays an important role in the formation of chronic wounds.

Systemic factors	Local factors
Metabolic diseases, such as diabetes mellitus	Size of the ulcer
Systemic diseases, such as rheumatic diseases	Age of the ulcer
Other forms of chronic disease, such as HIV infection	Location of the ulcer
Old age	Local circulation
Malnutrition / poor diet	Necrosis
Alcohol / narcotics abuse	Suppuration and maceration
Medicines, such as steroids, oestrogens, and vitamin K antagonists	Edema
Smoking	Exposed bones or capsules

Fig1 shows chronic non healing ulcer on forehead



Fig 2 showing application of leech on chronic non healing ulcer



Fig 3 showing partially healed chronic ulcer



Fig 4 shows completely healed chronic non healing ulcer after hirudotherapy



TREATMENT AND PREVENTION OF WOUND:

Hyperbaric Oxygen Therapy--- is used to treat very serious wounds. The patient breathes 100% oxygen in a pressurized chamber for 90-120 minutes. The oxygen dissolves into the blood and is distributed throughout the body, providing extra oxygen to the cells attempting to heal the wound. Hyperbaric oxygen treatments have been found to increase the rate of collagen deposition, angiogenesis, and bacterial clearance. Another benefit is that, if the wound environment has more oxygen, certain types of bacteria that cause serious infections cannot grow. This method has been used for many years in treating difficult or complicated, non-healing wounds. It is well recognized as a very effective treatment. Skin ulcers may take a very long time to heal. Treatment is typically to avoid the ulcer getting infected, remove any excess

discharge, maintain a moist wound environment, control the edema, and ease pain caused by nerve and tissue damage. Topical antibiotics are normally used to prevent the ulcer getting infected, and the wound or ulcer is usually kept clear of dead tissue through surgical debridement. Whirlpool Therapy is used by physical therapists once or twice daily for about 20 minutes during the inflammatory stage of healing to enhance circulation and bring more oxygen into the wound area. The whirlpool also softens and loosens dead tissue and cleanses the wound.

Ultrasound--- treatment uses mechanical vibration delivered at a frequency above the range of human hearing. Physical therapists report that covering the wound area with a hydrogel film and applying ultrasound during the inflammatory and proliferative stages stimulates the cells involved in

wound healing and also warms the tissue, enhancing healing by improving circulation.

Electrical Stimulation--- mimics the body's own bioelectric system that influences wound healing by attracting repair cells, changing the permeability of cell membranes, and therefore affecting secretions and orienting cell structures.

Nutritional Supplement--- Research has shown that certain nutrients such as aloe vera, arginine, glutamine, zinc, copper, and vitamin C play key roles in wound healing [Vaxman *et al.* 1990; Worwag *et al.* 1999]. The typical Western diet is deficient in these nutritional supplement.

L-Arginine---Injury significantly increases the need for the amino acid arginine, which is essential for a variety of metabolic functions arginine stimulates the cell-mediated immune response and protects against bacterial challenges [Gurbuz *et al.* 1998]

Glutamine---The amino acid glutamine is an important substrate for rapidly proliferating cells, including lymphocytes (white blood cells). It is also the major amino acid lost during muscle protein catabolism in the initial response to injury. Aloe vera--- provides the micronutrients required for protein synthesis. Its many components work together to reduce inflammation and pain, promote healing, and stop infection. Aloe can be applied topically to wounds and taken internally for both skin wounds and gastrointestinal ulcers

Turmeric Extract, Curcumin

Curcumin--- is an extract of the spice turmeric, known to have antioxidant properties and other health benefits. In Indian medicine, curcumin is used to reduce inflammation and treat wounds and skin ulcers. Topical application of curcumin encourages wound remodeling via effects on transforming growth factor-beta (TGF- β). It also improves reepithelialization (new skin formation) and migration of cells such as myofibroblasts, fibroblasts, and macrophages, necessary for healing at the wound site.

Bromelain--- is found in pineapple and contains a proteolytic enzyme with the ability to break down or dissolve proteins. This mechanism of action can be helpful in chronic wounds or wounds having too much scar tissue. According to the PDR for Nutritional Supplements [2001, p. 72], bromelain speeds up healing time after surgical procedures.

Copper---A German physician first observed the role of copper in healing

Zinc---The immune system is adversely affected by even moderate degrees of zinc deficiency. Severe

zinc deficiency depresses immune function. Zinc is required for the development and activation of T-lymphocytes, a kind of white blood cell that helps fight infection. Zinc can be used topically or orally to encourage wound healing and plays a well-documented role in wound healing

Vitamin C (Ascorbic Acid)--- is crucial for the proper function of the enzyme procollagen hydroxylase which produces collagen, the primary constituent of the granulation tissue that heals a wound and the key component in blood vessel walls. A published review stated that vitamin C plays a variety of roles in the prevention and treatment of cancer, including stimulating the immune system and enhancing wound healing [Head 1998]. Wound healing requires more vitamin C than diet alone can easily provide.

Pantothenic acid--- improves healing by encouraging the migration of cells into the wounded area,

Vitamin A--- is important for tissue synthesis and enhances resistance to infection.

B-Complex--- vitamins are needed for cell proliferation and for the replacement and maturation of red blood cells lost through bleeding.

ULCER GRADING:-

Wagner's grading of ulcer follow^[4]

Grade Description

- | | |
|---|--|
| 0 | Pre-ulcerative lesion or healed ulcer |
| 1 | Superficial ulcer |
| 2 | Ulcer deeper to subcutaneous tissue exposing soft tissue or bone |
| 3 | Abscess formation underneath, osteomyelitis |
| 4 | Gangrene of part of tissues, limb or foot |
| 5 | Gangrene of entire one area or foot |

- Bloody (sanguineous), usually seen in malignant ulcers and in healing ulcers with healthy granulation tissue
- Seropurulent
- Serosanguinous
- Serous with sulphur granules, seen in actinomycosis
- Yellowish, as seen in tuberculous ulcer

Complications

With any type of wound – even seemingly minor injuries – there is always danger of rapid multiplication of bacteria. The elderly and persons with reduced immunity are at great risk for wound-related infections. Once bacteria escape from the primary location of a wound, they enter the blood. This condition is commonly called blood

poisoning, septicemia, sepsis, or septic shock. Sepsis is always a serious, life-threatening condition, with 56% mortality. In the United States, sepsis occurs annually in some three cases per 1,000 population. In sepsis and septic shock, circulation is reduced; blood pressure is markedly reduced, causing vital organs to receive reduced blood supply; heart, kidney, and liver functions are reduced or show signs of shutdown (multiple organ failure); and abnormal bleeding can develop. Symptoms of septicemia and septic shock are sudden onset of illness, high fever, chills, rapid breathing, headache, and altered mental state.

Discussion

Clinicians' understanding of and ability to achieve wound healing has increased significantly over the past few years, particularly as a result of advances in molecular biology such as the use of growth factors, the ability to grow cells in vitro and the development of bioengineered tissue [23][24][25]. Knowledge of scarring has also increased fundamentally [26][27][28][29]. Some promising results have been obtained using epidermal growth factor [30] and keratinocyte growth factor-2 [31] for venous ulcers, and fibroblast growth factor [32] and platelet-derived growth factor (PDGF) for pressure ulcers [33],[34]. Bioengineered skin products or skin equivalents have become available for the treatment of acute and chronic wounds as well as burns. Since the initial use of keratinocyte sheets [21][22][23], several more complex constructs have been developed and tested in human wounds. Skin equivalents may contain living cells, such as fibroblasts or keratinocytes, or both [2], [24][25][26], while others are made of acellular materials or extracts of living cells[35]. There is evidence that some of these living constructs are able to release growth factors and cytokines [36],[37]. The technology to introduce certain genes into wounds by a variety of physical means or biological vectors, including viruses, has existed for some time. Work with gene therapy in relation to wounds has been done in experimental animal models [38]. pluripotential mesenchymal stem cells, which are

the source of new connective tissue, may be present in bone marrow [39]. (VEGF) has been reported to enhance healing and angiogenesis in selected patients with ulcers resulting from arterial insufficiency [38]. In carrying out this study it has been observed that the bioactive enzymes present in the leech saliva activates the healing process and revitalizes the slow, delayed or dead wounds and ensures proper healing. The study also provides us an adequate ground to go for further research that how the Hirudotherapy results in proper and smooth healing of the chronic non healing wounds without scarring.

CONCLUSION

As we have discussed the chronic wound healing in detail and focused on its different modern tools of management and latest gadgets of treatment available in the world and their application. It has been found that scientists are wondering for more specific and updated treatment with less side effects and more cost effectiveness. With this reason the team of scientists of CCRUM/RRUM Srinagar. Kashmir has done leeching (Hirudotherapy) in different diseases especially Diabetic Foot with highly successful results and simultaneously the Hirudotherapy was done in chronic non healing wound. The patient was given three applications of Hirudotherapy every after ten days and at the end of the therapy the wound was completely healed up. The patient was then followed up for complete one year but there was no history of recurrence. During the period of leech therapy and follow up period the patient did not take any topical or systemic medication. The healing in this study was attributed to the bioactive enzymes, anti-inflammatory substance and natural steroids etc. present in the leech saliva. This research further opens the door for scientists that how Hirudotherapy takes care of non-recurrence of the wound without using latest measures and therapies and also without giving further antiseptic and antibiotic coverage.

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