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A REVIEW OF WOUND: CURRENT ASPECTS AND NOVEL MANAGEMENT

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ABSTRACT

A wound may be defined as a break in the epithelial integrity of the skin or may also be described as a loss or breaking of cellular and anatomic or functional continuity of living tissue. Healing is a survival mechanism that maintains normal anatomical structure and function. Treatment is therefore aimed at minimizing the undesired consequences. Management of the healing of wounds is a complicated and expensive program, and research on drugs that increase wound healing is a developing area in modern biomedical sciences. The correct approach to treating wounds should effectively assist the healing process, and it can significantly impact the final clinical outcome. The use of herbal medicines and traditional plant extracts for wound healing is gaining popularity over other drugs, which may be explained by the perception that they have fewer side effects.

Keywords: Wound, Treatment, Puncture, Hypersensitive, Healing,

INTRODUCTION

In ordinary pathology, wounds stay a problematic clinical issue, with ahead-of-schedule and late intricacies introducing a successive reason for morbidity and mortality[1,2]. In an endeavour to decrease injury trouble, much exertion has zeroed in on understanding the physiology of recuperating and wound care, accentuating new restorative methodologies and advancing innovations for intense and long-haul wound management[3,4]. The enormous social and financial effect of wounds results from their high pace of events and their rising recurrence in the maturing populace. Notwithstanding countless intense injuries, there are additionally an enormous number of ongoing, complex to-mend wounds related to infections and irregularities that straightforwardly or in a roundabout way finish in harm of the cutaneous inclusion, including blood vessel, venous, diabetic and pressure ulcers. The pervasiveness of these persistent injuries increments with age. For instance, it has been assessed that ongoing injuries influence 120 for every 100000 individuals who matured somewhere between 45 and 65 years and ascends to 800 for every 100000 individuals > 75 years old. [1,2] Furthermore, because of the confusion with intense injuries, while their recuperating doesn't advance conveniently and deliberately, they can change over into constant injuries[1].

Characterization of Wounds

Based on the underlying cause of wound creation, wounds can be characterized as

Open wounds: In this situation, blood gets away from the body, and draining is apparent. It is additionally delegated: Incised injury, Laceration or tear wound, Abrasions or shallow injuries, Puncture wounds, Penetration wounds and gunshot wounds. [6]

Closed wounds: In closed injuries, blood escapes from the circulatory framework yet stays in the body. It incorporates Contusions or injuries, haematomas or blood tumours, crush injuries, etc.

Based on the nature of the repair process, wounds can be characterized as

Acute wounds: Acute wounds are tissue wounds that heal entirely with minimal scarring within the expected time frame, usually 8-12 weeks. Acute wounds are usually caused by cuts or surgical incisions and complete the wound-healing process within the expected time frame. [5]

Chronic wounds: Chronic wounds arise from tissue wounds that heal slowly, do not heal beyond 12 weeks and often reoccur. Local infection, hypoxia, trauma, foreign bodies, and systemic problems such as diabetes mellitus, malnutrition, immunodeficiency or medications are the most frequent causes of chronic wounds. [7,8]

Based on the number of skin layers and area of skin affected, wounds can be classified as

Superficial wounds: Injury that affects the epidermal skin surface alone is alluded to as a superficial wound. [9,10]

Partial thickness injury: Injury that includes the epidermis and the deeper dermal layers, including the veins, sweat glands and hair follicles, are alluded to as partial thickness injury. [9,10]

Full thickness injury: Injury happens when the underlying subcutaneous fat or more profound layers are harmed, notwithstanding the epidermis and dermal layers. [9,10]

Wound Healing

Wound healing is a complex (however efficient) biological cycle or peculiarity in the human body started in response to an injury that re-establishes the function and integrity of harmed tissues and

includes an arranging course of cell-cell and cell-matrix interaction. This complicated course of tissue fix comprises a progression of coordinated occasions of bleeding and coagulation, chemotaxis of inflammatory cells, expansion of granulation tissue, neovascularization, synthesis/deposition and development of new extracellular matrix, and renovating of scar [11-14]. Healing of wounds is a primary reaction to tissue injury through a course of connective tissue fixes. A fibrous scar results from this process, the pre-prevailing constituent of which is collagen. Healing is a survival mechanism that aims to keep up with ordinary anatomical structure and function.

Treatment is accordingly pointed toward limiting the undesired outcomes. The board of healing of wounds is a muddled and costly program, and the exploration of drugs that increment wound healing is a creating region in present-day biomedical sciences. Legitimate healing of wounds is fundamental for the reclamation of disrupted anatomical continuity and disturbed useful status of the skin. Wound healing includes consistent cell-cell and cell-matrix interactions that permit the interaction to continue in three covering stages, viz. inflammation (0-3 days), cell proliferation (3-12 days) and remodelling (3-6 months). The essential guideline of ideal wound healing is to limit tissue damage and give adequate tissue perfusion and oxygenation, legitimate nutrition and a moist wound healing environment to reestablish the anatomical continuity and function of the impacted part. Wound healing continues through precisely and exceptionally customized stages: Hemostasis, inflammation, proliferation and remodelling, which are controlled by several mediators, including cytokines and different other secreted development factors that guarantee quick and compelling recuperating. [15-17]

Homeostasis

The quick stage after an injury is homeostasis, wherein platelets, different variables like insulin-like and epidermal-like development factors (IGF, EGF), fibronectin, fibrinogen, histamine, platelet-derived growth factor (PDGF), serotonin, and von Willebrand factor (vWF) begins to migrate at the injury site within 24 hours to control bleeding and limit the degree of injury. The quick motivation behind this stage is to keep blood misfortune from the harmed blood vessels. Homeostasis can be partitioned into three phases:

1. Primary/Essential homeostasis, in which the platelets and vascular reaction play a significant part and briefly capture the bleeding.
2. Secondary/Auxiliary homeostasis, in which the coagulation factors form fibrin and balance out the platelet plug, and the blood becomes solid to semisolid mass at the injury site and,
3. The third homeostasis includes the course of fibrinolysis, the evacuation of blood clumps for additional healing. [18,19]

Inflammatory phase

Clinically inflammation, the second and vital phase of wound healing, is represented by the influx of polymorphonuclear leukocytes (neutrophils), macrophages, and lymphocytes to the site of the wound within 24-36 hours of injury by the chemo-alluring agents to phagocytose the foreign material like microscopic organisms and to start granuloma tissue arrangement and angiogenesis. The complicated grouping of cell and molecular occasions instigates exemplary indications of inflammation, for example, the hotness and redness, agony, and swelling in the injury. [15]

Proliferative phase

The proliferative stage is portrayed by the arrangement of granuloma tissue and wound contraction, which begins on the roughly 4th day of the wound and typically continues until the 21st day. In granulation tissue development, fibroblasts, the primary cell type, begins to multiply to deliver matrix components and are responsible for wound contraction. Angiogenesis or Neo vascularization means to elevate the supplement supply to keep up with cell metabolism and make a flawless delivery framework [Figure 1].

Remodelling phase

Remodelling is the last phase of the wound healing process, where granulated tissue is changed into mature connective tissue. During this stage, there is a decrease in the cellularity and vascularity of the injury while the cross-connecting of collagen renovates the extracellular matrix. Finally, these stages are decentralized in a wholly developed scar with a diminished number of cells and blood vessels. Physiologically wound healing process is a characteristic course of self-healing. However, there is a need to give better cures that can recover the harmed tissue.[19,20]

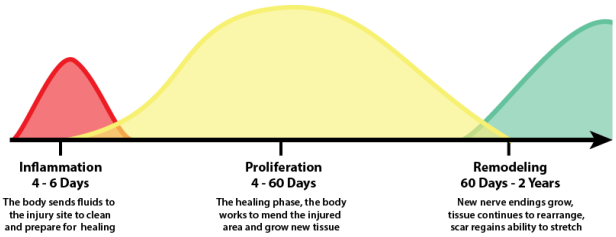

Figure 1: Different phases of wound healing

Healing by Primary and Secondary intention

Successful wound healing relies upon the convenient and ideal working of numerous cycles, cell types, molecular mediators, and underlying components. Various cells dominate different phases of repair, and cell patterns shift as per the various kinds of injury and the degree of tissue damage. During normal wound healing, closed incisions, and severe injuries with tissue defects progress through coordinated molecular and cellular occasions, resulting in either regeneration or tissue repair. The least complicated example of wound repair is healing clean wounds without tissue loss and uninfected surgical incisions approximated by sutures. This is referred to as healing by primary intention. Death of a limited number of epithelial and connective tissue cells occurs because of minor disruptions in basement membrane continuity. It is a fast process that contrasts markedly with the healing of an open wound with extensive tissue loss. Here, the reparative process is more complicated because significant tissue losses have to be filled, which occurs during healing by secondary intention. This process takes longer than healing by the first intention, and large amounts of granulation tissue are formed to fill the tissue defect. Numerous pathophysiological and metabolic factors can affect wound healing and result in poor outcomes. They include local causes, such as oedema, ischemia, tissue hypoxia, infection, necrosis and growth factor imbalance, and systemic causes, including metabolic disease, nutritional status, general perfusion disturbances, or pre-existing illness. These factors alter the wound repair environment, impeding healing and turning the acute wound into a chronic one.

Management of wounds

The correct approach for treating wounds should effectively assist the healing process and impact the final clinical outcome. Physiological, endocrine and nutritional support at a clinical level significantly influence repair; without them, wound healing often fails. The first stage of wound management should be a thorough assessment of the wound and the patient. The process begins with diagnosing the wound's aetiology and continues with optimizing the patient's medical condition, specifically the blood supply to the wounded area. An acute wound in a stable patient with normal blood flow should heal successfully if appropriate care is given. Later the wound will need to be debrided and dressed correctly. Sufficient debridement, defined as the removal of non-viable, infected and hyperkeratotic tissue, forms the basis of non-delayed and delayed wound healing. Debridement is essential as it accelerates wound healing, and different techniques exist.

Herbal plants exhibiting wound healing activities [21]

Name	Used parts	Formulations	Unwanted side effects	Clinical evidence	Commercial products
Jasminum auriculatum	Leaves, flower	Liquid extracts (ethanol)	Hypersensitivity reactions after prolonged use	Animal studies	*Jasminum grandiflorum* leaf extract
Aloe vera	Mucilage from inner leaf parts	Gels and ointments for cutaneous use	Hypersensitivity to aloe	Animal studies and case studies	Aloe extracts, gels and ointments for cutaneous use
Angelica sinensis	Whole herbs, roots	Liquid extracts, dried liquid extracts and strips	No specific unwanted side effects are reported for cutaneous use	Animal studies and cell cultures	No commercially available products for cutaneous use
Azadirachta indica	Seed oil, bark	Liquid extracts in organic solvents	Possibly allergic in high doses	Animal studies and cell cultures	Neem extract Align™ and neem fruits
Calendula officinalis	Flower	Liquid extracts, ointments and comminuted herbal substances	Hypersensitivity to members of the Asteraceae family	Animal studies and cell cultures	Oils, ointments and seeds are sold for various purposes
Centella asiatica	Leaves	Ointments, cutaneous powder as an adjuvant and cream	Allergy to plants of the Apiaceae family	Animal studies, non-controlled case studies, clinical studies on small patient groups	Centallase® ointment for keloidal scars, Madecassol® for treatment of systemic and localized scleroderma
Chamomilla recutita	Flower	Powdered form, liquid extracts (tinctures, oil extracts, lotions and infusions)	Hypersensitivity to the active substance and other plants of the Asteraceae	Animal studies, case studies and clinical trials	Kamillosan® for wound healing and eczema treatment
Chromolaena odorata	Leaves	Aqueous extracts and decoction from leaves, comminuted leaves ground into a paste	Not reported against mammals, highly allelopathic against other plants	Animal studies and cell cultures	Formulations prepared from the aqueous extract (Eupolin) of the leaves have been licensed for clinical use in Vietnam
Commiphora myrrha	Gummiresina	Tinctures	Allergic contact dermatitis	Case studies and animal studies	Mirazid®, marketed for the treatment of schistosomiasis
Curcuma longa	Rhizome	Rhizome in the form of paste, ointment or powder	It may enhance the anti-inflammatory effects of other medicines, leading to toxic effects	Animal studies, case studies and clinical trials	Whole rhizome, powder and solutions thereof are commercially available in different countries
Echinacea	Whole plant	Herbal preparations in semisolid or liquid dosage form	Hypersensitive reactions (local rash, contact dermatitis, eczema and angioedema of the lips)	Animal studies, cell cultures, case studies and clinical trials	Echinacin, Madaus AG
Helianthus annuus	Whole plant, leaves, flower	Liquid extracts (tinctures, fluid extracts)	Possible mild irritation	Animal studies, cell cultures, and case studies	Oleozon® for the treatment of tinea pedis
Achillea	Whole plant, flower	Liquid dosage forms for cutaneous use	Allergic reactions and photosensitivity after skin exposure	Animal and case studies	Extracts (in polypropylene glycol) used in cosmetic products
Rosmarinus officinalis	Whole or cut-dried leaves	Liquid or semisolid dosage forms	Hypersensitivity to the active substance (possible contact dermatitis)	Animal studies, case studies, safe for food applications (FDA)	Herbor® rosemary extract
Hydnocarpus wightiana	Seeds	Oil extracts, comminuted seeds in the form of a paste	Hypersensitive skin reactions if used as concentrated oil extracts	Animal studies and case studies	Hydnocarpus seed oil

In the case of chronic wounds, the measures used to reverse medical abnormalities are complex, and the aetiology of the wound is not easy to identify. Correct debridement helps to convert a chronic wound into an acute one, which can then progress through the normal stages of healing. The accumulation of devitalized tissue in the wound promotes bacterial colonization and impairs the body's ability to fight infection, thereby preventing the complete repair of the wound. Debridement aims to remove ischemic and necrotic tissue, which presents a potential threat for infection and contamination of the tissue by bacteria and foreign bodies. During the operation, necrotic and vital tissues are distinguished by a lack of capillary refill, colour and clear demarcation. Dead muscle fibres do not contract on stimulation and are poorly perfused. Special tissues, such as tendons and fascia, are not removed despite not being vital because they promote the healing process in the wound. The next important step is the lavage of micro-organisms, dead tissue and foreign bodies, which can further decrease bacterial tissue counts. Commonly, a bacitracin solution is used [19].

Novel management options for wounds

Various medical approaches and therapeutic interventions can affect the different processes involved in the wound-healing cascade. The healing time may be shorter when there is less injured tissue, for example, during minimally invasive surgery, which reduces the amount of soft tissue damage and postoperative morbidity. Novel topical growth factor application techniques and incisional priming with PDGF or IL-1 can optimize both the cellular and molecular environment, thus decreasing healing time by modifying inflammation and accelerating the proliferative phase. Electrical field stimulation may also optimize the remodelling phase by promoting more efficient fibroblast recruitment and collagen deposition. Prosthetic materials can favour tissue repair, and gene therapy, currently in pre-clinical development, may provide selective healing [19].

CONCLUSION

Understanding wound healing is as essential as knowing the disease's pathogenesis because adequate wound healing is the ultimate goal of the treatment. Several plants offer a great deal of therapeutic potential for use in the case of wound healing. Using medicinal plants for wound healing also provides an edge compared to drugs due to the absence of adverse effects. Secondary metabolites and other products produced by various plants benefit wound healing. Because of the ability to create multiple plant preparations for topical use, these have enormous potential in future therapeutic approaches in wound care. Recent developments in novel extraction technologies and newly discovered knowledge about traditional uses of various plants contribute significantly to the popularization of physiological and therapeutic studies of herbs and herbal materials. This, in turn, contributes to a growing number of herbal products for wound healing purposes.

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