



EXPLORATION OF HERBAL DRUGS USED IN WOUND HEALING ACTIVITY

K. M. Ramya Sravani^a, Sai Padmini. D^b, S. Mohana Lakshmi^b

^a Gokaraju rangaraju college of pharmacy, Bachupally, Hyderabad, 500092, India.

^b Sree Vidyanikethan College of Pharmacy, A. Rangampet, Tirupati, 517102, India.

*Corresponding author's E-mail: komalsravani@gmail.com

Accepted on: 15-11-2011; Finalized on: 20-02-2012.

ABSTRACT

Wound, a clinical entity is as old as mankind but healing of chronic cutaneous wounds is still a great problem. Wound healing occurs by a process of connective tissue repair and ends by formation of fibrous scar, the predominant constituent of which is collagen. According to traditional medicine wounds have been treated topically with various medicinal herbs or their extracts since times immemorial. But till now a lot of research has been envisaged to develop better wound healing agents and it has been a challenging task to generate them and keep up pace with problems encountered. Since a very few synthetic wound healing agents are available still now, the search for safer and effective wound healing agents from medicinal plants have become more important areas of bioactive research. The present exploration reveals about those plants that possess wound healing activity. Some of those plants are *Vernonia arborea*, *Elephantopus scaber*, *Euphorbia hirta*, *Pterocarpus santalinus*, *Clerodendrum serratum*, *Saussurea lappa*, *Acalypha langiana*, *Tragia involucrate*, *Solanum violaceum*, *Vitex pinnata*, *Tinospora cadifolia*, *Artemisia palens*, *Psidium cujavirus*, *Zea mays*, *Camilla Cracchiolo*, *Moringa oleifera*, *Aegle marmelos*. The benefits of these traditional treasures are discussed in detail in the present review.

Keywords: Wound, Healing, Mechanism, Natural Herbs.

INTRODUCTION

The human body is truly remarkable. Wound healing is an ability possessed by the body to repair damaged parts – this process is sometimes visible (a cut improves) or microscopic (damaged cells are replaced) but both occur on a daily basis, and are given the term: regeneration. In the animal kingdom – a starfish can rebuild a new tentacle that is cut off, an earthworm can replace much of its body that is lost, and crabs can rebuild a new claw when one is lost.

Wound, a clinical entity is as old as mankind, often possesses problems in clinical practice. Naturally the investigative curiosity to promote the healing continues since ages. A wound disrupts the normal status of living tissue. Wound healing is a dynamic process begins at the moment of wounding. Wound healing acts as a survival mechanism to maintain normal status of living tissue. It depends upon the reparative abilities of tissue, type and extent of damage, general health status of tissue. The granulation tissue of wound is composed of collagen, fibroblast, edema, and small blood vessels. Healing of wounds occur by a process of connective tissue repair with fibrous scar as an end product, the predominant constituent of which is collagen. Since time immemorial wounds have been treated topically with various medicinal herbs are their extracts. In developed countries also, people are seeking alternative to modern therapies of wound healing like antibiotics, corticosteroids, etc obviously due to its side effects. Herbal wound healing agents are rapidly emerging these days. Normally the potency of herbal wound healing agents is studied by using: Excision wound model, Incision wound model and

Dead space wound. The present study aims to present a review on herbal wound healing agents and their potential advantages. A review of some on herbal products for wound treatment is provided to through light on the recent technical advancements in this area.

PATHOLOGY OF WOUNDS

Wounds are physical injuries that result in an opening or break of skin. They should be healed properly essential for the restoration of disrupted anatomical continuity and disturbed functional status of the skin. Wound healing, or wound repair, is the body's natural process of regenerating dermal and epidermal tissue. Healing process starts in response to an injury that restores the function and structure of damaged tissues when an individual is wounded¹. A set of complex biochemical events takes place in a closely orchestrated cascade to repair the damage. These events overlap in time and may be artificially categorized into separate steps: The inflammatory, proliferative, and remodeling phases. Healing process starts in response to an injury that restores the function and structure of damaged tissues. Wound healing involves continuous cell-cell and cell-matrix interactions. Wound healing involves platelet aggregation, blood clotting, fibrin formation, and an inflammatory response, alteration in the ground substances, angiogenesis and re-epithelialization. Healing gets complete by the formation of collagen. This process can go continuously and produce an exuberance of fibroblastic proliferation with a resultant hypertrophic scar, which by definition is confined to the wound site.

Optimal wound healing is to minimize tissue damage, provide adequate blood supply to tissues, oxygenation,



proper nutrition and moist wound healing environment to restore the anatomical continuity and function of the affected part. Cutaneous wound repair is an ordered and sequence of biological events starting with wound closure and progressing to the repair and remodeling of damaged tissue. The availability of drugs capable of stimulating the process of wound repair is still limited. The management of chronic wounds is another major problem due to the high cost of therapy and the presence of untoward side effects reactive oxygen species (Ros) are deleterious to wound healing process due to the harmful effects on cells and tissues. Absorbable synthetic biomaterials are considered to be degraded via Ros. Free-radical-scavenging enzymes are a cytoprotective enzymatic group that has a role in the removal of Ros as well as regulating wound healing process.

AYURVEDIC REMEDIES FOR WOUNDS HEALING

Ayurveda, the Indian traditional system of medicine, is based on empirical knowledge of the observations and the experience over millennia. Management in various forms of these diseases is made with medicinal plants, minerals, metals, ores and animal and marine products. Healing of wounds is one of the important areas of clinical medicines explained in many Ayurveda texts and are termed as "vranaropaka". According to the Ayurveda, vrana (wounds or ulcers) is the discontinuation of lining membrane that after healing leaves a scar for life closely resembling the modern definition. Maharshi agnibesha in agnibesha samhita (later known as charaka samhita) described wound as "vrana". Different types of wounds are mentioned in Ayurveda, some of them may be endogenous in origin due to a defect in human functional units, such as vata, pitta, and kapha or exogenous due to trauma such as chinna, bhinna, viddha and kshata. Herbal drugs are aimed to accelerate the healing process and also to maintain the quality and aesthetics of the healing.

ETHNOBOTANICAL APPROACHES TO WOUND HEALING — INDIAN PERSPECTIVE

An Ayurveda, siddha and unani medicine employs a large number of medicinal plants for treatment of skin diseases which includes cuts, wounds and burns. Medicinal plants have been used since olden time for treatment of various ailments of skin and dermatological disorders especially cuts, wounds and burns. A classical application of plant-based medicine in treatment of injuries is described in the Indian epic Ramayana, lakshman lay mortally wounded on the battlefield in lanka, and medicinal plants from Himalayas were used to restore lakshman to fighting strength. In developed countries also, people are seeking alternative to modern therapies of wound healing like antibiotics, corticosteroids, etc because of their side effects. Pathogenesis and failure to heal of modern medicines paved a way to herbal medicines. In the current review, attempt is made to present plants which have been reported in ethnobotanical literature for use in wound healing.

ETHNO PHARMACOLOGICAL VALIDATION

Research into traditional wound healing remedies fall into three categories: (1) herbal remedies; (2) the use of animal, insect products as wound healing agents; (3) the use of organisms to effect wound healing. Although traditional medicines offer a safe, inexpensive approach to treatment of wounds and burns, it has not received adequate importance. One of the reasons to neglect this area is that it falls outside WHO priority disease areas. Another reason is that there is a prevailing view that traditional system of health care most suit for use with chronic, low-level conditions rather than treatment of acute conditions. A third possible reason is that injuries and chronic wounds tend to be treated locally rather than being presented at clinics under the most advanced stage of pathology. In spite of all these there are a number of plants which have been reported for their wound healing activity. Most of these studies involve random screening of plant or extracts for wound healing activity.

MECHANISM OF WOUND HEALING

Wound healing is a complex process in which the skin or the affected organ repairs itself after injury. In normal conditions the outermost layer of the skin i.e., epidermis and the inner or deeper layer i.e., dermis exists in steady-state equilibrium and forms a protective barrier against the external environment. If this protective barrier is broken due to any injury the normal physiologic process of wound healing is immediately instigated. Upon injury to the skin, a set of complex biochemical events takes place in a closely organized cascade to repair the damage. Within few minutes after the injury, platelets aggregate at the injury site to form a fibrin clot. This clot acts to control the active bleeding and to achieve homeostasis. The entire wound healing process that begins at the moment of injury can continue for even months or years. There are three main phases of wound healing viz., inflammatory phase, proliferative phase and remodeling phase. These phases are briefly described here.²

Inflammatory phase: The inflammatory phase starts immediately after the injury that usually lasts between 24 and 48 h and may persist for up to 2 weeks in some cases. The inflammatory phase launches the haemostatic mechanisms to immediately stop blood loss from the wound site. Clinically recognizable cardinal signs of inflammation, rubor (redness), calor (warmth), tumor (swelling), dolor (pain) and function less (loss of function) appear as the consequence. This phase is characterized by vasoconstriction and platelet aggregation to induce blood clotting and subsequently vasodilatation and phagocytosis to produce inflammation at the wound site.

Proliferative phase: The second phase of wound healing is the proliferative phase that lasts up to 2 days to 3 weeks after the inflammatory phase. This phase comprises of three steps viz., granulation, contraction and epithelialization. In the granulation step fibroblasts form a bed of collagen and new capillaries are produced. Fibroblasts produce a variety of substances essential for



wound repair including glycosaminoglycans and collagen. Under the step of contraction wound edges pull together to reduce the defects. In the third step fresh epithelial tissues are formed over the wound site.

Remodeling phase: This phase lasts for 3 weeks to 2 years. New collagen is formed in this phase. Tissue tensile strength is increased due to intermolecular cross-linking of collagen via vitamin C-dependent hydroxylation. The scar flattens and scar tissues become 80% as strong as the original tissue.

Wound healing process

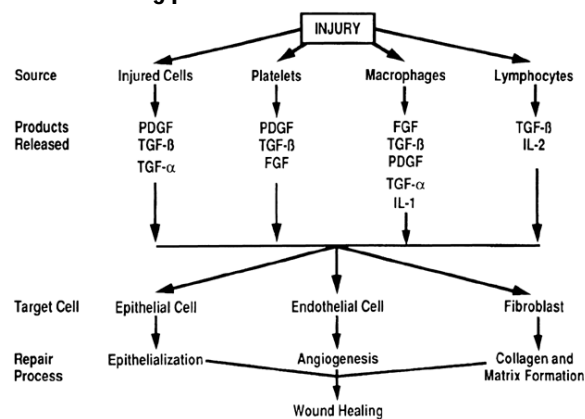


Table 1: Plants with reported activity

Name of plant	Family	Parts used	Uses
<i>Acalypha langiana</i>	Euphorbiaceae	Fresh leaves	Wound healing
<i>Aloe vera</i>	Aloaceae	Leaves, latex	Wound healing
<i>Alternanthera sessilis</i>	Amaranthaceae	Leaves	Antibacterial, wound healing
<i>Artemisia pallens</i>	Asteraceae	Whole plant	Cuts and wounds
<i>Azadiracta indica</i>	Meliaceae	Whole plant	Diabetes, Antibacterial
<i>Catharanthus roseus</i>	Apocynaceae	Flowers	Antidiabetic, Antitumor
<i>Cecropia peltata</i>	Cecropiaceae	Leaves	Wounds
<i>Cleodendron serratum</i>	Verbenaceae	Leaves, roots	Asthma, wounds
<i>Cynodon dactylon</i>	Poaceae	Grass	Anticonvulsant
<i>Elephantopus scaber</i> ³	Asteraceae	Whole plant	Eczema, wounds, ulcers
<i>Euphorbia hirta</i> ⁴	Euphorbiaceae	Aerial parts	Cuts, wounds, boils, burns
<i>Ginkgo biloba</i>	Ginkgoaceae	Leaf	brain disorders, bronchitis
<i>Jatropha curcas</i>	Euphorbiaceae	Leaf	Paralysis, skin diseases
<i>Kaempferia galanga</i>	Zingiberaceae	Rhizomes	Wounds
<i>Lycopodium serratum</i>	Lycopodiaceae	Leaf	Wounds
<i>Lawsonia alba</i> ⁵	Lythraceae	Leaf	Wounds
<i>Morinda citrifolia</i>	Rubiaceae	Leaves	Wounds
<i>Murraya koenigii</i>	Rutaceae	Leaf	Antioxidant, antibacterial
<i>Myristica andamanica</i>	Myristicaceae	Aerial parts	Wounds
<i>Napoleona Imperialis</i> ⁶	lecythidaceae	Leaf	Antihypertensive
<i>Prosopis cineraria</i>	Fabaceae	Aerial parts	Analgesic, Antihelmenthic
<i>Pterocarpus marsupium</i> ⁷	Papilionaceae	Stem bark	Boils, sores, skin diseases
<i>Pterocarpus santalinus</i> ^{8,9}	Fabaceae	Leaf, stem	Cuts, wounds, boils, inflammation
<i>Radix paeoniae</i>	Paeoniaceae	Roots	Hepatoprotective
<i>Salvia splendens</i>	Lamiaceae	Leaves	Emetic, dysentery
<i>Saussurea lappa</i> ¹⁰	Asteraceae	Roots	Asthma, bronchitis
<i>Sesamum indicum</i>	Pedaliaceae	Roots	Wounds
<i>Solanum violaceum</i>	Solanaceae	Leaf	Rheumatic pains, wounds
<i>Terminalia bellirica</i>	Combretaceae	Fruits	Wound, antiseptic
<i>Tinospora cardifolia</i> ¹¹	Menispermaceae	Stem, leaves	Ulcers, leprosy
<i>Tragia involucrata</i>	Euphorbiaceae	Roots	Pain, wounds, swellings, Eczema
<i>Trigonella foenumgraecum</i> ¹²	Fabaceae	Seeds, Aerial parts	Reduces appetite
<i>Vernonia arborea</i> ¹³	Asteraceae	Leaf, Bark	Wounds
<i>Vitex pinnata</i> ¹⁴	Verbenaceae	Leaves	Analgesic, anti-inflammatory, antipyretic



Table 2: Plants found in and around chittoor district

S.No	Family	Name of the plant	Common name	Parts used
1	Anacardiaceae	<i>Buchanania axillaries</i>	Sarapappu	Leaf
2	Balsaminaceae	<i>Impatiens balsamina</i>	Chilaka mukukupuvvu	Flower
3	Celastriaceae	<i>Pleurostyliya opposita</i>	Piyari	Leaf
		<i>Cassine glauca</i>	Neridi, nirija	Flower
4	Caesalpiniaceae	<i>Bauhinia variegata</i>	Madapaku cheth	Flower
		<i>Delonix elata</i>	Chittikesaram	Stem bark
5	Crassulaceae	<i>Kalanchoe verticillata</i>	Seema ranapala	Leaf
		<i>Kalanchoe pinnata</i>	Gallarapaku	Leaf
		<i>Kalanchoe laciniata</i>	Kondakalli	Leaf
6	Combretaceae	<i>Arogeissus acuminata</i>	Pasichettu	Leaf
7	Elatinaceae	<i>Bergia capersis</i>	---	Whole plant
8	Flacourtiaceae	<i>Homalium zeylanicum</i>	Manthrala mukhi	Leaf
9	Flindersiaceae	<i>Chloroxylon swieteria</i>	Billudu	Leaf
10	Fabaceae	<i>Psium sativum</i>	Batani	Seed
		<i>Sesbania sesban</i>	Jeeluga	Flower
		<i>Pterocarpus marsupim</i>	Yegi	Stem bark
		<i>Desmodium motarum</i>	Thanthi chettu	Whole plant
11	Haloragaceae	<i>Myliophyllum oliganthum</i>	Erra kada	Whole plant
12	Lauraceae	<i>Actinodaphne maderaspatana</i>	Pandiri patra	Leaf
13	Loranthaceae	<i>Dendrophthoe falcate</i>	Kukka naluka	Whole plant
14	Malpighiaceae	<i>Thyralis glauca</i>	Teega avalu	Leaf
15	Malvaceae	<i>Gossypium herbaceum</i>	Patti, pratti	Seed
		<i>Hibiscus mutabils</i>	Mirapa mandara	leaf
16	Meliaceae	<i>Azadirachta indica</i>	Vepa, vemu	Flower
		<i>Cipadessa baccifera</i>	Chedubira	Leaf
		<i>Soymida febrifuga</i>	Somi, sumi	Stem bark
17	Mimosaceae	<i>Acacia polycantha</i>	Tellakachu	Stem bark
		<i>A. Nilotica</i>	Nalla thumma	Fruit, seed,
		<i>A. Farnesiana</i>	Arimaidham	Stem bark
		<i>Albizia odoratisima</i>	Kondasigara	Fruit
		<i>Mimosa pudica</i>	Attipathi	Whole plant
18	Myrtaceae	<i>Mystus communis</i>	Panneen jamu	Leaf
		<i>Eucalyptus citriodora</i>	Nimma thylam	Leaf and gum
19	Melastomaceae	<i>Melastoma</i>	Nakka nalupu	Root and stem bark
20	Oxalidaceae	<i>Biophytum sensitivum</i>	Pedda attipati	Seed
21	Polygalaceae	<i>Polygala erioptera</i>	---	Leaf
22	Piperaceae	<i>Piper bettle</i>	Thammeraku	Leaf
23	Rutaceae	<i>Murraya pariculata</i>	Pulavelagu	Leaf
24	Rhamnaceae	<i>Swtia myrtina</i>	Budidhapallu	Fruit
		<i>Sageretia parviflora</i>	Gutta ari	Leaf
25	Sapindaceae	<i>Dodonaea viscose</i>	Bandew	Leaf
		<i>Filicium decipiens</i>	Pettakunkudu	Leaf
26	Taliaceae	<i>Grewia tiliaefolia</i>	Peddhajana, boddkibodda	Stem bark
27	Viscaceae	<i>Viscum articulatum</i>	Kadabadenika	Whole plant

CONCLUSION

The plants reported in the present article are reported for their wound healing activity. Plants possessing wound healing activity and are found in and around chittoor district, Andhrapradesh, India are also reported. Pantothenic acid (vitamin b5), other B vitamins, vitamin c,

pantothenic acid, zinc, ornithine, alpha-ketoglutarate (glutamine), vitamin A, vitamin E, copper, bromelain, thiamine, manganese, copper, silicon, hyaluronic acid, glucosamine sulfate and chondroitin sulfate had a role in wound healing. Pathogenesis and failure to heal wounds by the modern medicines paved a way to herbal medicine.



REFERENCES

1. McAnalley BH, Carpenter RH, McDaniel HR, Harley R and Carrington Laboratories, Inc. Wound healing accelerated by systemic administration of polysaccharide from aloe. 1995, US 5468737.
2. Strodtbeck F. Physiology of wound healing, Newborn Infant Nurs. Rev, 1, 2001, 43-52.
3. Krishna V. Wound healing activity of the leaf extracts and deoxyephentopin isolated from *Elephantopus scaber* Linn, Indian J Pharmacol, 37 (4), 2005, 238-242.
4. Karadi RV. Wound healing activity of *Euphorbia hirta* Linn, Indian drugs, 43(2), 2006, 112-116.
5. Mandawade SD, Patil KS. Wound healing potential of some active principles of *Lawsonia Alba* leaves, Ind. J. Pharm. Sci, 65, 2003, 390-394.
6. Esimone CO, Ibezim EC, Chah KF. The wound healing effect of herbal ointments formulated with *Napoleona imperialis*, J. Pharm. Allied Sci, 3, 2005, 294-299.
7. Krishna V. Evaluation of wound healing property of *Pterocarpus marsupium* stem barks, Indian drugs, 42(7), 2005, 432-436.
8. Manjunatha BK. Studies on wound healing potency of *Pterocarpus santalinus* an endangered medicinal plant, Indian drugs, 42(12), 2005, 819-823.
9. Manjunatha BK, Kumar S, Patel A. The studies on wound healing potency of *Pterocarpus santalinus* an endangered medicinal plant, Indian Drugs, 42, 2005, 819-823.
10. Ganachari MS. Wound healing activity of *Saussurea lapra* roots, Indian drugs, 42(5), 2005, 295-297.
11. Shanbhag T. Wound healing profile of *Tinospora cardifolia*, Indian drugs, 42(4), 2005, 217-221.
12. Taranalli AD, Kuppast IJ. Study of wound healing activity of seeds of *Trigonella foenum* graceum in rats, Indian J. Pharm. Sci, 58, 1996, 117-119.
13. Singh SDJ. Evaluation of wound healing potency of *Vernonia arborea* Hk, Indian J Pharmacol, 37 (4), 2005, 223-226.
14. Patro CP. Wound healing and pyretic activity of aqueous extract of leavs of *Vitex pinnata*, Indian drugs, 44(7), 2005, 532-534.

