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Review Article

A REVIEW OF BURN INJURY AND ITS MANAGEMENT IN AYURVEDIC SYSTEM OF MEDICINE: A COMPARATIVE STUDY FOR LOCAL WOUND CARE

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ABSTRACT

Burn injury has been associated with the evolution of human civilization since time immemorial. Burn injuries has always been faced by human in different era with change of mode injury from past to present. Unlike other diseases the basics of burn injury remains more or less same. The basic concepts and principles of management of burn injury is described in Ayurveda are very much relevant and useful in this era of modern surgery. Sushrut Samhita, the treasure of surgical knowledge of ancient Indian civilization, is a rich source of information regarding burn injury, assessment and management. Most of the other scholars of Ayurveda follow the basic concept of Sushrut Samhita. All the Brihatrayee (three greater treatises) and Laghu trayee (three lesser treatises) and other relevant textbooks of Ayurveda studied to search the different data regarding *Dagdha vrana* (burn injury), etiological description, gradation, different principles of treatment and available dressing material. The collected data evaluated scientifically to make it usable in the modern era of surgery. The result shows that although there is change in mode of burn injury found in modern era, the basic principles of etiology, classification, management and use of dressing material are almost the same as standard burn wound management of contemporary medical science. So the benefits of Ayurveda can be inducted in modern era of burn care.

KEYWORDS: Ayurveda, *Dagdha vrana,* Burn wound, Susrut Samhita.

INTRODUCTION

Burn injury is a problem which affects persons of all age and sex. Burn is one of the top causes of death and disabilities worldwide. Burn injury has been there since ancient time though mode of burn injuries has also been changing. From a simple burn from a hot cup of tea to a complicated burn in war combats, modern civilization burn injuries involve various complicated mechanisms, patho-physiologies and outcomes. Frequency, severity and prognosis of burn injuries depend upon the socio-economic conditions of the individual as well as group of people the patient belongs to. Life style, access to preventive methods and availability of health care facilities are important factors in burn injury cases. Electrification of vast areas, criminal use of acids, chemical warfare etc. has added a different dimension in modalities of burn injuries. An estimated 300000 deaths are caused by burn every year. Burns are among the leading cause of disability adjusted life years (DALY) lost in the under-developed and developed countries. Globally there are 10 million of DALY lost every year [1]. In 2004, nearly 11 million people worldwide were burned leading to medical care. In India, over 1000000 people are burnt every year. Before a few decades burn injury was a dreaded challenge with high morbidity and mortality rates. But with better understanding of intra venous fluid management and other resuscitation and advancements in technologies, even most severe of burn injury stands a fair chance of survival. In the last seventy years, critical advances were introduced which caused dramatic increase in survival of burnt patient.[2] Presently burn care is a multidisciplinary team effort with experts from different fields working together for a definitive positive outcome.

Burn injury involves complex pathology. Burn patients are more predisposed for infection due to suppressed immunity. Burn wound is a fertile land for the growth of various microorganisms. Due to more or less destruction of microcirculation in the burnt area, systemic antibiotics are not very much effective in treating local wound infections. Also the rise of antibiotic resistant organisms, is posing a great problem in use of systemic antibiotics. With increase in survival, complications of burn wound healing like discoloration, contractures resulting in reduced loss of range of motion have to be faced. So wound healing without these unwanted complications is always desirable for burn care.

Hence there is always a space for an ideal drug for local application in burn wound.

Ayurveda is the time tested system of treatment prevalent in India since long time. It is a treasure house of knowledge gathered in thousands of years. The main treaties of Ayurveda are Brihatrayee viz. Charak Samhita, Sushrut Samhita, Astanga Samgrah or Astanga ahriday and Laghutrayee viz. Madhav Nidan, Sharangadhar Samhita, Bhavaprakasha, as well as in treatises like Yoga Ratnakar and Harit Samhita descriptions of burn injury are found. Sushrut Samhita is the authenticated text book of surgical knowledge of Indian civilization. It contains detailed descriptions of basic surgical knowledge like wound healing and management of various wounds along with surgical procedures. It contains vivid descriptions of burn injury and its management. In this study we have tried to summarize the literature available regarding burn wound in Ayurveda and compare it with the contemporary knowledge to find a scope to reincorporate the findings of Ayurveda into modern burn care.

Materials and method

Classical textbooks of Ayurveda like Susrut Samhita, Charak Samhita, Astanga Samgrah, Astanga Hriday, Madhav Nidan, Sharangadhar Samhita, Bhavaprakasha, Yoga Ratnakar and Harit Samhita were studided. Online database like Google, Pubmed, Researchgate, etc. were searched. The keywords searched were burn wound, herbs for topical application in burn wound, wound care in burn injury.

Burn Wound Management

Management of burn wound depends upon the depth of the injury along with other factors common for all types of wounds. Bedside clinical evaluation remains the most widespread and cost-effective method for depth diagnosis. [3]

Depth of burn wound

A. Susruta Samhita

Clinical features of all the types mentioned above are described in terms of appearance, presence/absence of blisters, presence/absence and nature of pain, suppuration, extent of tissue destruction, time and nature of healing, systemic involvement etc. which indicates the depth of damage due to thermal injury [4].

1. ***Plusta:*** Discoloration; Burning pain without any blisters.
2. ***Durdagdha:*** Blisters, severe pain, redness, suppuration, pain lasting for long duration.
3. ***Samyagdagdha:*** Without the features of *Atidagdha* , colour of ripe palm tree fruit, neither elevated nor depressed, along with the features as mentioned above.
4. ***Atidagdha:*** Sloughing out, injuries of vessels, ligaments, joints and bones; fever; burning sensation; thirst; fainting; the wound heals very slowly; discoloration after healing.

B. Modern classification of burn depth on clinical appearance

Typical clinical appearance of burn depth:

1. **First degree:** Involves only the epidermis and never blisters. It appears as a "sunburn" and is not included in the %TBSA calculation.
2. **Second degree superficial:** Pink, homogeneous, normal capillary refill, painful, moist, intact hair follicles
3. **Second degree deep:** Mottled or white, delayed or absent capillary refill, dry, decreased sensation or insensate, non-intact hair follicles
4. **Third degree:** Dry, white or charred, leathery, insensate.

C. Burn depth according to the healing time

Superficial or first degree burns heal within 7 days; second degree superficial or partial superficial thickness heal within 14 days; deep partial thickness heal within three weeks and in case of full thickness burns after three weeks granulation starts.

So keeping in view the descriptions found in Susrut Samhita with contemporary classification we can compare them as following:

Modern description	Ayurvedic description
First degree	*Plusta*
Second degree Superficial	*Plusta*
Second degree Deep	*Samyagdagdha*
Third degree	*Atidagdha*

Principle of Treatment

Susruta Samhita

Different treatment principles have been described according to the type of burn injuries [4]. Treatment will be effective only after determination of type of burn.

1. ***Plusta:*** Application of heat (*Swedan*), medicine, local application, food etc. should be of hot potency.
2. ***Durdagdha:*** Cold therapy in deep burn and hot therapy in superficial burn. There is another opinion that if there is excessive burning sensation cold therapy and in case of absence of excessive burning sensation. *Ghritalepa* and *Seka* etc should be cold.

3. *Samyagdagdha*

I. Local application of *Tugaksheeri, Plaksha, Chandan, Gairik, Guduchi*, and *Ghrita*. This mixture does not dry soon, and pacifies *Pitta*.

II. Paste of different types of land and aquatic animals; it pacifies *Vata*.

III. If there is excessive burning pain, *Pittavidradhi* like treatment.

4. *Atidagdha*

I. Surgical debridement

II. Cold therapy

III. Local application of *Shali tandul kanva* with *Ghrita*; or *Tinduki tvaka, Kapal* and *Ghrita*.

IV. Covering the wound with leaves of aquatic plants like *Utpal* etc. If the wound is involved with *Pitta* and *Rakta*, then use of *Guduchi* leaves for wound covering helps in removing *Usma* and in *Vranaropan*.

V. Treatment like *pita Visarpa*.

Table1: Common Dressing Material for All Types of Burns

Drugs	Source
Lepa containing beeswax*, Madhuka, Rodhra, Sarjarasa, Manjistha, Chandan, Murva, Ghrita*	Susrut Samhita[4], Yoga Ratnakar[5]
jatyadi taila: *Tila* oil processed with *Kalka* of leaves of *Jati, Nimba, patola*, *Naktamal*, Beeswax, *Madhuka*, *Kustha*, *Haridra*, *Daruharidra*, *Katurohini*, *Manjistha, Padmak, Pathya, Lodhra, Nilkamal, Sariba, Tuthak,* fruit of *Naktamala*	Sarangahara Samhita[6]; Bhava Prakash[7]
Tugaksheeri, Plaksha, Chandan, Gairik, Guduchi, Ghrita	Sarangahara Samhita[6]
Pathya, Kardam, Jiraka powder, beeswax, *Sarjarasa, Ghrita*	Yoga Ratnakar[4]
Kutherak (Sweta tulsi) churna prepared by *Antardh umak* process, mixed with honey or water.	Yoga Ratnakar[4]
Powder of dried *Aswath* bark	Yoga Ratnakar[4]
Oil (*Til* oil prepared by *Taila pak* process) processed with earthworm	Yoga Ratnakar[4]
Dagdhayava bhasma powder, mixed with *Til* oil	Yoga Ratnakar[4]
Katu taila processed with *Kalka* and *Kasay* of *Patola*	Yoga Ratnakar[4] Bhava Prakash[7]
Kalka of *Chandan*, *Vatasringa*, *Manjistha*, *Madhuka*, *Prapoundarik*, *Durva*, *Patanga*, *Dhataki*; processed with *til* oil and cow's milk	Yoga Ratnakar[4]
Langaliu ghrita: Haridra, Daruharidra, Manjistha, Madhuka, Lodhra, Katphala, Kampillak, Meda, Mahameda, Pippali, Triphala, Nimbapatra; mixed with *Goghrita* and cow's milk and Beeswax	Yoga Ratnakar[4]
Dhataki flower powder mixed with *Atasi* oil	Yoga Ratnakar[4]
Triphala powder prepared by *Antardhuma dagdha*, mixed with *Atasi* oil	Yoga Ratnakar[4]
Local applications which are useful in *Pittavidradhi* and *Visarpa*	Yoga Ratnakar[4]
Shalitanduladi ghrita lepa; application of *Shali*, *Tandul kanva*, *Tinduki tvaka*, *Ghrita*	Bhava Prakash[7]
Ghee processed with *Siktaka*, *Kardama*, *Jirak*, *Madhu*, *Pathya*	Bhava Prakash[7]
Ghrita, Karpur Churna, Gairik, Lodhra	Harit Samhita[8]
Amlaki, Tila, Kustha	Harit Samhita[8]
Mixture of Paste of *Lodhra, Ushir, Manjistha*, mixed with cold water	Harit Samhita[8]
Oil extracted from *Atasi, Mulethi, Ghrita*	Harit Samhita[8]

Burn wound care in modern medicine

Superficial wounds may require minimal additional therapy. Deeper burn wounds need more aggressive therapy, with standard approach being serial excision and autografting. In indeterminate and deep second degree wounds, excision is delayed until maximum depth and extent are known.

1. Superficial second degree

The aim is to achieve spontaneous rapid re-epithelialisation without any infection. Dressing options are biological or semi biological dressings, topical antimicrobials, standard dressings either

impregnated or free from a topical agent or by exposure method.

2. Deep partial and full thickness wound

Early excision and grafting has become the gold standard for treatment of full and deep partial thickness burns [9,10] in part because early excision helps reduce the risk of infection and scarring[11-13]. Excision within 24 to 48 h after injury is associated with decreased blood loss, infection, length of hospital stay and mortality, and increased graft take[14-17]. Covering the wound as early as possible are critical. The standard for rapid and permanent closure of full-thickness burns is a split-thickness skin graft from an uninjured donor site on the same patient (autograft). Patients with more extensive burns often require temporary coverage with an allograft, xenograft, skin substitute, or dermal analog due to insufficient or unavailable donor sites.[18]

Tissue engineering and regenerative medicine (TERM), a new approach in wound healing products can be classified into two major categories: cell-based skin constructs and a cellular productions. These products include a wide variety of materials which have been categorized as epidermal and dermal substitutes.[19]

Classification of wound dressings

1. Traditional dressing: Cotton wool, natural or synthetic bandages and gauzes
2. Modern dressings: hydrocolloids, alginates, hydrogels, semipermeable adhesive film dressings, foam dressings, biological dressings and tissue engineered skin substitutes.

Other classifications

1. Functionality of the dressing (occlusive, absorbent etc.),
2. Types of material (hydrogel, collagen etc.),
3. Physical form of the product (gel, ointment etc.)
4. Primary dressings which are in physical contact with the wound surface, secondary dressings that cover the primary dressing, and island dressings made up of an absorbent region in the middle and a surrounding adhesive part.

Different types of dressing materials:

1. **Gauzes:** Affordable and easily accessible offer good absorption though found to be inappropriate for wounds that produce little wound exudates.
2. **Films:** Thin adhesive and semiocclusive membranes serving the purpose of as both primary and secondary dressings, managing moisture by vapor transmission and are good barriers against foreign liquid and bacteria. But may lead to trapping of fluid and subsequently maceration of wound.
3. **Hydrocolloids:** Adhesive, occlusive and absorbent dressings.
4. **Alginates:** Fibrous dressings which form into gels upon contact with the moisture in wounds and are able to absorb high amounts of fluid. Good for wounds with moderate to heavy exudates.
5. **Foams:** Semi occlusive dressings having the ability to absorb moderate amounts of fluid. Useful for management of wounds with light and moderate levels of exudates.
6. **Biological dressings:** Contain biomaterials that support wound healing e..g. collagen, elastin and chitosan.
7. **Hydrogels:** They are semi permeable and have the ability to transmit vapor and water, provide moisture to the wound, and obtain relief by their cooling[20]

The ideal wound dressing

According to the current medical literature, no ideal dressing—one that would adapt to all wounds at all times—has yet been identified. Characteristics of an ideal dressing would be the following[21]

- Provide an optimum environment for moist wound healing
- Allow gaseous exchange of oxygen, carbon dioxide and water vapor
- Provide thermal insulation
- Impermeable to microorganisms
- Free from particulate contaminants
- Non-adherent
- Safe to use
- Acceptable to the patient
- High absorption properties
- Cost-effective
- Allows monitoring of the wound
- Provide mechanical protection
- Nonflammable
- Sterile
- Available in all settings
- Requires infrequent changes
- Ready to use to reduce dressing time

It is desirable that dressing can be left for longer period, so that wound remains undisturbed and healing becomes rapid, and also reduces pain, suffering and metabolic consequences in patients. But contaminated and infected wound should be dressed more frequently[22].

STUDIES ON HERBAL PREPARATIONS

Following are the various studies on herbal preparations for burn wound.

Agent	Application
Ghruta (ghee) and *Madhu* (honey)	burn wound[23]
Amygdalus eburnea	3rd degree burns in rats[24]
Jatyadi ghrita and *Taila*	burn wound[25], rats[26]
Honey	Burn wound healing[27][28]
Argyreia Speciosa	2nd degree and 3rd degree burns[29]
resin of *Shorea robusta*	2nd degree[30]
Manjisthadi Taila with *Kadalipatra*	2nd degree[31]
Zanthoxylum bungeanum maxim seed oil	on experimentally burned rats[32]
Chandanadi yamakam	Burn wounds[33]
Tephrosia purpurea (L) Pers	Partial Thickness and Full Thickness Burn Wounds in Rats[34]
Albizia Julibressin	2nd degree and 3rd degree burns[35]
Arnebia euchroma	2nd degree[36]
Lithospermum officinale	Burn Wound Injuries in Rat[37].
leaf extracts of Madeira vine	burn wound in albino rats[38]
Crocodile oil	Burn ointment[39]
Sesamum indicum L, *Pistacia atlantica* Desf., *Cannabis sativa* L., *Juglans regia* L.	3rd degree burns in mice[40]
Scutellariae herba extracts	experimental model of skin burns[41]
Aloe Vera Gel	Superficial Second-Degree Burns[42]
aqueous extracts of *Malva sylvestris* and *Solanum nigrum* leaves and oily extract of *Rosa damascena* petals	Second-degree in rats[43]
herbal extracts of *Rubus caesius* L. (Rosaceae) and *Sambucus nigra* L. (Caprifoliaceae)	experimental third-degree skin burns[44]
barks *of Spathodea campanulata Beauv* (Bignoniaceae)	rat experimental burn model[44]
Essential oils	*In vitro*[46]
Papaya	Clinical trial, 2nd, 3rd degree[47]

DISCUSSION

Local application of medicine has a great role in burn wound management. Drugs used for local application should have properties like antimicrobial, debridement capacity, capable of providing healing environment, having good tissue penetration, etc. In modern medicine many drugs like mafenamide acetate, bacitracin, mupirocin, and topical silver preparations are used. It has been suggested that topical antibiotics may be more likely to lead to development of resistance than systemic antibiotics [48].

Silver sulphadiazine is known to be cytogenic and percutaneous absorption may lead to leucopenia. Silver sulfadiazine destroys skin grafts and is contraindicated on burns or donor sites in proximity to newly grafted areas. Also, silver sulfadiazine may retard epithelial migration in healing partial-thickness wounds[49]. Again some topical antibiotics also form pseudoeschar that may interfere with assessment and outcome. Again prolonged application of these may produce argyria. Use of mafenide acetate may be limited by pain with application to partial-thickness burns. Mafenide is absorbed systemically, and a major side effect is metabolic acidosis resulting from carbonic anhydrase inhibition[49]. Prolonged topical application of Silver nitrate leads to electrolyte extravasation with resulting hyponatremia. A rare complication is methemoglobinemia. Gram-positive and Gram-negative bacterial infections still remain one of the

most common causes of mortality following burn injury.[50] Importantly, effective topical antimicrobials do not exist for invasive fungal infections, and fungal wound infections are associated with greater mortality rates in large burns (>30 % TBSA)[51]. A recent Cochrane review finds that there is dearth of high quality Randomized Controlled Trials on dressings for superficial and partial thickness burn injury. The authors summarized that available evidence was of limited usefulness in aiding clinicians to choosing suitable treatments[52]. Again antibiotic resistance is posing a great threat and the present time has been termed the "end of the antibiotic era"[53]. It is opined that easily treatable infections could in future become essentially untreatable as in the days before antibiotics were discovered.[55] Easy accessibility of antibiotics over the counter, wrong prescription practices, poor patient compliance leading to stopping treatment too early and overuse of antibiotics in livestock feedstuffs are thought to be the causes of antibiotic resistance [56]. This fact is affecting burn wound also. Again in extensive burn wounds, the conventional treatment options have not been shown to be effective and new modalities with better efficacy, availability and compatibility have been required

It has been observed that lots of medicines have been mentioned in Ayurvedic classics for the care of burn wound. They have immense potential to fill up the gaps in the modern burn wound care. But there are very few high quality Randomised Controlled Trials on these drugs. Also there is almost no study about their effects on the microbiology of burn wound. Similarly there is no proper histopathological study on their effects on wound healing.

CONCLUSION

Ayurvedic classics mention a lot of preparations for burn wound care. These medicines had been used in ancient times and pre-antibiotic era most probably with success. So there is a need of revalidating these preparations in terms of modern parameters and thus making them acceptable, accessible and available for the people. To serve this purpose there is a need of collaborative study with inputs from different branches of science.

REFERENCES

1. WHO, 2008, A WHO plan for burn prevention and care, Geneva, Switzerland, Page2.
2. Tompkins, Ronald G, Survival from Burns in the New Millennium: 70 Years' Experience From a Single Institution Annals of Surgery 261(2):263-268, February 2015.
3. Devgan L, Bhat S, Aylward S, Spence RJ. Modalities for the Assessment of Burn Wound Depth. Journal of Burns and Wounds. 2006;5:e2.
4. Vaidya Jadavji Trikamji Acharya and Narayan Ram Acharya Kavyatirtha. Susrutsamhita of Susruta. Varanasi. Choukhambha Sanskrit Sansthan. 2015. p. 396, 52-54.
5. Vaidya Sri Lakshmipati Sastri, Edited by, Visagratna Shri Brahmansankar Sastri. Yogaratnakar with Vidyotini Hindi tika.Varanasi. Choukhambha Sanskrit Sansthan. Reprint-2005. p. 185-1882.
6. Dr. Smt. Shailaja Srivastav. Sharangadhar Samhita of Acharya Sharangadhar. Varanasi. Choukhambha Orientalia. 2013. p. 237, 444.
7. Prof. K. R. Srikanth Murthy. Third Edition. Bhavaprakash of Bhavamisra.Vol. 2, Varanasi. Choukhambha Krisnadas Academy, 2005. p. 566-567.
8. Vaidya Jayanti Pandey. Harit Samhita. Choukhambha Viswabharati. Varanasi. 2010. p. 501-502.
9. Janzekovic Z. A new concept in the early excision and immediate grafting of burns. J Trauma. 1970;10:1103–8.
10. Orgill DP. Excision and skin grafting of thermal burns. N Engl J Med. 2009;360:893–901.
11. Barret JP, Herndon DN. Effects of burn wound excision on bacterial colonization and invasion. Plast Reconstruct Surg. 2003;111:744–50. discussion 751–2.
12. .Cramer LM, McCormack CR, Carroll DB. Progressive partial excision and early graftin in lethal burns. Plast Reconstruct Surg Transplant Bull. 1962;30:595–9.
13. Engrav LH, Heimbach DM, Reus JL, Harnar TJ, Marvin JA. Early excision and grafting vs. nonoperative treatment of burns of indeterminant depth: a randomized prospective study. J Trauma. 1983;23:1001–4.
14. Desai MH, Herndon DN, Broemeling L, Barrow RE, Nichols Jr RJ, Rutan RL. Early burn wound excision significantly reduces blood loss. Ann Surg. 1990;211:753–9. discussion 759–62.
15. Herndon DN, Barrow RE, Rutan RL, Rutan TC, Desai MH, Abston S. A comparison of conservative versus early excision. Therapies in severely burned patients. Ann Surg. 1989;209:547–52. discussion 552–3.
16. Saaiq M, Zaib S, Ahmad S. Early excision and grafting versus delayed excision and grafting of deep thermal burns up to 40 % total body surface area: a comparison of outcome. Ann Burns Fire Disasters. 2012;25:143–7.
17. Vinita P, Khare NA, Chandramouli M, Nilesh S, Sumit B. Comparative analysis of early excision and grafting vs delayed grafting in burn patients

in a developing country. J Burn Care Res. 2014; doi:10.1097/BCR.0b013e31827e4ed6.
18. Rowan MP, Cancio LC, Elster EA, et al. Burn wound healing and treatment: review and advancements. Critical Care. 2015;19:243. doi:10. 1186/s13054-015-0961-2.
19. Teepe RG, Kreis RW, Koebrugge EJ, Kempenaar JA, Vloemans AF, et al. (1990) The use of cultured autologous epidermis in the treatment of extensive burn wounds. J Trauma 30(3): 269-275
20. Boateng, J., Matthews, K., Stevens, H., & Eccleston, G. (2008). Wound healing dressings and drug delivery systems: A review. Journal of Pharmaceutical Science, 97(8), 2892-2923.
21. ISBI Practice Guidelines Committee, ISBI Practice Guidelines for Burn Care, Burns, Volume 42, Issue 5,2016,Pages 953-1021.
22. ISBI Practice Guidelines Committee, ISBI Practice Guidelines for Burn Care, Burns, Volume 42, Issue 5,2016,Pages 975.
23. Dnyandeo, Mandar, treatment of burn wound by ghruta(ghee) and madhu (honey)-a case report, iamj: volume 4; issue 02; January -2016, 45.
24. Rezaeifar, Rezaeifar, effect of amygdalus eburnea on third-degree burns in rats and comparison with silver sulfadiazine ointment, Asian J Pharm Clin Res, Vol 10, Issue 5, 2017, 376-378.
25. Swer, Chandravanshi, S, S V, a case study of burn wound treated with Jatyadi ghrita, IAMJ: June, 2017, 2237- 2240.
26. Dhande, Priti & Simpy, R & Kureshee Nargis, I & Sanghavi Dhara, R & Pandit Vijaya, A. (2012). Burn wound healing potential of Jatyadi formulations in rats. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 3. 747-754.
27. Subrahmanyam, Sahapure, Nagane, Bhagwat, Ganu, Effects of Topical Application of Honey on Burn Wound Healing, Annals of Burns and Fire Disasters - vol. XIV - n. 3 - September 2001.
28. Yaghoobi R, Kazerouni A, kazerouni O. Evidence for Clinical Use of Honey in Wound Healing as an Anti-bacterial, Anti-inflammatory Anti-oxidant and Anti-viral Agent: A Review. Jundishapur Journal of Natural Pharmaceutical Products. 2013;8(3):100-104.
29. Jain, Ayyappan, Shaikh, Naik, Baranwal, Herbal Alternative in Topical Burn Therapy, Indian Journal of Volume - 12 / Issue - 01 / December 2008, 58-62.
30. Sahasrabudhe, Dhondge, Panse, Raal ointment compared with 1% silver sulfadiazine cream for the treatment of second degree burns, Indian Journal of Burns || December 2014, 37-42.
31. Shekokar, Borkar, Pandao, Londe, A Case Study of Manjistadi Taila with Kadalipatra and Bactigauze for Local Application in the Management of Burn, International Journal of Advanced Ayurveda, Yoga, Unani, Siddha and Homeopathy, 2013, pp. 112-118.
32. Li XQ, Kang R, Huo JC, Xie YH, Wang SW, Cao W. Wound-healing activity of Zanthoxylum bungeanum maxim seed oil on experimentally burned rats. Phcog Mag [serial online] 2017 [cited 2018 May 6];13:363-71. Available from: http://www.phcog.com/text.asp?2017/13/51/3 63/211021.
33. Kishor Kumar KH et al., Management of Burn Wounds by Compound Ayurvedic Preparation Chandanadi Yamakam, International Journal of Ayurvedic Medicine, 2010, 1(2), 109-117.
34. Lodhi, S., Pawar, R., Jain, A., et al. (2010). Effect of Tephrosia purpurea (L) Pers. on Partial Thickness and Full Thickness Burn Wounds in Rats. Journal of Complementary and Integrative Medicine, 7(1), pp. -. Retrieved 6 May. 2018, from doi:10.2202/1553-3840.1344.
35. Asgarirad H, Chabra A, Rahimnejad M, Zaghi Hosseinzadeh A, Davoodi A, Azadbakht M. Comparison of Albizia Julibressin and Silver Sulfadiazine in Healing of Second and Third Degree Burns. World Journal of Plastic Surgery. 2018;7(1):34-44.
36. Nasiri, Hosseinimehr, Hosseinzadeh, Azadbakht, Akbari, Azadbakht, The effects of Arnebia euchroma ointment on second-degree burn wounds: a randomized clinical trial, Journal of Ethnopharmacology, Volume 189, 2 August 2016, Pages 107-116.
37. Mohtasham Amiri Z, Tanideh N, Seddighi A, et al. The Effect of Lithospermum officinale, Silver Sulfadiazine and Alpha Ointments in Healing of Burn Wound Injuries in Rat. World Journal of Plastic Surgery. 2017;6(3):313-318.
38. Yuniarti WM, Lukiswanto BS. Effects of herbal ointment containing the leaf extracts of Madeira vine (Anredera cordifolia (Ten.) Steenis) for burn wound healing process on albino rats. Veterinary World. 2017;10(7):808-813. doi:10.14202/ vetworld. 2017.808-813.
39. Li H-L, Deng Y-T, Zhang Z-R, et al. Evaluation Of Effectiveness In A Novel Wound Healing Ointment-Crocodile Oil Burn Ointment. African Journal of Traditional, Complementary, and Alternative Medicines. 2017;14(1):62-72. doi:10.21010/ajtcam.v14i1.8.
40. Mehrabani M, Seyyedkazemi SM, Nematollahi MH, et al. Accelerated Burn Wound Closure in Mice with a New Formula Based on Traditional

Medicine. Iranian Red Crescent Medical Journal. 2016;18(11):e26613. doi:10.5812/ircmj.26613.
41. Cornelia Bejenaru et al., Effect of Scutellariae herba extracts in experimental model of skin burns: histological and immunohistochemica assessment, Rom J Morphol Embryol 2016, 57(4):1285–1294.
42. Irani PS, Varaie S. Comparison of the Effect of Aloe Vera Gel and Nitrofurazone 2% on Epithelialization and Granulation Tissue Formation Regarding Superficial Second-Degree Burns. Iranian Journal of Medical Sciences. 2016;41(3 Suppl):S3.
43. Fahimi S, Abdollahi M, Mortazavi SA, Hajimehdipoor H, Abdolghaffari AH, Rezvanfar MA. Wound Healing Activity of a Traditionally Used Poly Herbal Product in a Burn Wound Model in Rats. Iranian Red Crescent Medical Journal. 2015;17(9):e19960. doi:10.5812/ircmj. 19960.
44. G. D. Mogoşanu et al., Comparative study of microvascular density in experimental third-degree skin burns treated with topical preparations containing herbal extracts, Rom J Morphol Embryol, 2013, 54(1):107–113.
45. Sy GY, Nongonierma RB, Ngewou PW, Mengata DE, Dieye AM, Cisse A, Faye B., . Healing activity of methanolic extract of the barks of Spathodea campanulata Beauv (Bignoniaceae) in rat experimental burn model, Dakar Med. 2005;50(2):77-81.
46. Edwards-Jones V, Buck R, Shawcross SG, Dawson MM, Dunn K. The effect of essential oils on methicillin-resistant Staphylococcus aureus using a dressing model. Burns. 2004;30(8):772–7. [PubMed].
47. Starley IF, Mohammed P, Schneider G, Bickler SW. The treatment of paediatric burns using topical papaya. Burns. 1999;25(7):636–9. [PubMed].
48. Nakamura Y, Daya M. Use of appropriate antimicrobials in wound management. Emerg Med Clin North Am. 2007; 25(1):159–76. [PubMed: 17400079].
49. Schwartz, Seymour I., and F. Charles Brunicardi. Schwartz's Principles of Surgery. 10th ed. New York, N.Y.: McGraw Hill Medical, 2015.232.
50. D'Avignon LC, Hogan BK, Murray CK, Loo FL, Hospenthal DR, Cancio LC, et al. Contribution of bacterial and viral infections to attributable mortality in patients with severe burns: an autopsy series. Burns. 2010;36:773–9
51. Horvath EE, Murray CK, Vaughan GM, Chung KK, Hospenthal DR, Wade CE, et al. Fungal wound infection (not colonization) is independently associated with mortality in burn patients. Ann Surg. 2007;245:978–85.
52. Wasiak J, Cleland H, Campbell F (2008) Dressings for superficial and partial thickness burns. Cochrane Database Syst Rev (4):CD002 106.
53. Poole MD. Are we facing the end of the antibiotic era? Ear Nose Throat J. 1993;72(6):433. [PubMed].
54. Davies J. Where have All the Antibiotics Gone? Can J Infect Dis Med Microbiol. 2006;17(5):287–90. [PMC free article] [PubMed].
55. Dai T, Huang YY, Hamblin MR. Photodynamic therapy for localized infections-State of the art. Photodiagnosis Photodyn Ther. 2009;6(3–4):170–88. [PMC free article] [PubMed].

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