

A TRADITIONAL HERBAL MANAGEMENT OF GANGRENE BY USING *TEPHROSIA PURPUREA* (L.) PERS., *CURCUMA LONGA* L. AND *FICUS BENGALENSIS* L.

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Abstract:

Gangrene is a necrosis caused by lack of blood circulation. The skin colour may change from red to black, swelling, numbness, pain, ulcer formation and detachment of local skin are the common symptoms of Gangrene. The most commonly affected body parts are feet and hands. This condition may be due to infection, injury or other health conditions like diabetes. The amputations carried out due to gangrene are very challenging. But Indian traditional herbal formulation given by Mrs. Bharathi from Chandragiri (Mandal), Chittoor (dist), Andhra Pradesh has been healing the gangrene completely without going for amputations. Traditionally this knowledge about herbal formulations has been obtained from her father. She has been using aerial parts of *Tephrosia purpuria* (L.) pers., powder of *Curcuma longa* L. and aerial roots of *Ficus bengalensis* L. for the gangrene treatment. Present article will be focussing on a traditional herbal management method for Gangrene caused due to diabetes by using medicinal plants like *T. purpurea*, *C. longa* and *F. bengalensis*.

Key words: necrosis, diabetes, traditional knowledge and amputations.

1. Introduction:

Gangrene is a condition which leads to necrosis of different parts of the body due to blockage of blood circulation, infection and injury. The tissue gets died as a result of depleted oxygen levels. The common conditions which leads to gangrene are injuries, external vascular diseases (e.g., in diabetes and chain smoking) and some other infections. Fingers, toes, and limbs are primarily affected by the gangrene, but it can also affect muscles and organs. There are different kinds of gangrene.

The chances of acquiring gangrene may be increased due to adverse health conditions like diabetes, trauma, serious injury, narrowed arteries, obesity, smoking, peripheral artery disease, Raynaud's phenomenon and weakened immune system, which may be affecting blood flow to various organs.

1.1 Main types of gangrene:

Dry Gangrene: It can be seen in people with diabetes and autoimmune diseases. It generally affects the feet and hands. It is due to reduced circulation of blood to the specific area of the body. After tissue gets dried, the colour changes to purplish-blue black or brown and falls off. There will be no infection in this type of gangrene unlike other types of gangrene. If dry gangrene gets infected then it can lead to wet gangrene.

Wet Gangrene: In this type an infection may lead to gangrene. In case of trauma and burns, the crushed body parts may not receive blood supply which leads to killing of the tissue thus raising the chances of infection. The tissue becomes wet due to the pus produced by swelling and blisters. In wet gangrene the infection spreads quickly around the body.



Types of wet gangrene:

Internal gangrene: Internal organs such as colon or appendix will be affected by such type of gangrene.

Gas gangrene:

It is dangerous and rare. It can be observed in the cases of trauma where some one is infected deep inside their body like organs or muscles. Infections due to Clostridia, may lead to deposition of dangerous toxins and gas which may be trapped in the tissue. Even skin may look gray and pale with a crackling sound when it is pressed. If it is not treated immediately it can be deadly within 48 hours.

Fournier's gangrene: It is rare and caused by genital area infections. Often it is observed in men than the women. It will be life threatening if the infection enters the blood stream, leading to a condition called as sepsis.

Meleney's gangrene (Progressive bacterial synergistic gangrene): This type of gangrene leads to painful lesions on the skin due to trauma or 1 to 2 weeks after surgery [1].

In some cases of Gas gangrene and Fournier's gangrene amputations may be required for the body parts. But in cases where amputations are not required, treatment will be given through revascularization and hyperbaric oxygen therapy, debridement and wound care.

Every year there are globally one million amputations being carried out, approximately for every 30 seconds there will be one amputation. By the year 2030, it is estimated that the toll of amputations may reach 435 million. Among these more than 54% cases will be affected by external vascular diseases and diabetes mellitus [2].

A very high mortality can be observed in people who are undergoing amputation with vascular diseases [3]. Further patients who undergo amputation are psychologically affected which can slowdown their improvement[4]. Usually amputation is done in patients with compromised blood flow, which can reduce the chances of healing of the wound after completing the surgery[5]. In the present article we are focussing on a traditional herbal management method for healing gangrene caused due to diabetes by using *T. purpurea*, *C. longa* and *F. bengalensis*.

2. Method of usage of herbal formulation:

The plant parts which are used for herbal formulation are fresh aerial parts of *T. purpurea* (Figure 1) dried powder of *C. longa* and fresh aerial roots *F. bengalensis*. Initially the aerial parts of *T. purpurea* have to be collected freshly and washed to remove dirt and grinded adding some turmeric powder and water into a fine paste. Later after washing the effected area of the patient with gangrene, the grinded paste has to be applied and tied with a dressing cloth and should be kept for next morning. Again in the morning after removing the bandage wound has to be washed with the water of *F. bengalensis* roots (soaked in water for over night) (Figure 2). After washing the wound again the same paste of aerial parts of *T. purpurea* and turmeric powder was applied and tied with a dressing cloth. The same dressing has to be repeated in the evening again by washing with water of *F. bengalensis* roots (soaked in water for 12 hrs). With this treatment gradually within a week to 10 days wound starts healing and in case of bone damage the bone also starts regenerating to normal condition. This treatment can be continued up to two months until the wound heals completely.

Traditional medicine can also be known as indigenous or folk medicine contains the knowledge that has been developed from many generations. It is developed among the societies before the invention of modern medicine. Traditional medicine include practices like Ayurveda, Siddha, Iranian, Vietnamese, Unani, Islamic, Chinese, Acupuncture, Muti, Ifá, African and various other practices from all over the world. The formalized folklore medicine which has been passed from one generation to the other by the lay people may also be included in traditional medicine.

Traditional medicine is defined by WHO, as ‘the health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral-based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintain well-being[6].

In the present time, awareness about importance and the usage of traditional medicine has been increased. Plants are used as medicine by nearly four billion people throughout the world as other medicines are not affordable[7]. Generally patients between 30 and 49 years of age are alternative medicine[8]. Commonly women are using CAM more than the men[9,10,11].

T. purpurea is a herb which belongs to the family Fabaceae, which is potentially distributed. This plant is called as “Sarwawranvishapaha” in Ayurveda, which means it can heal any kind of wound[12]. It is commonly found in wastelands and used as a home remedy for healing wounds. Earlier literature reveals this plant as folk medicine and also used as broad spectrum medicine to treat wounds and cuts. It can also reduce inflammation effectively[13].

T. purpurea have wound healing potential and can improve maturation of collagen by cross linking. It also contains antioxidants which can prevent the damage caused due to free radicals by removing superoxide radicals. The ethanolic extract of *T. purpurea* have effective wound healing capacity as it contains large number of fibroblast and collagen fibers which promote angiogenesis inside the wound. The ethanol extract of the plant significantly stimulates contraction of the wound by increasing its tensile strength[14].

The whole plant ethanolic extraction in the form of decoction shows dose dependant inhibition in both acute and chronic inflammation[15]. A Significant antibacterial activity was shown by ethanolic extract of *T.purpurea*. Flavonoids present in plant were showing effective antimicrobial activity[16]. The Phytochemical studies on *T.purpurea* reveals the presence of various secondary metabolites like isoflavones, rotenoids, flavanones, chalcones, flavanols, glycosides and sterols[17]. As the plant possess antibacterial activity and presence of various potent secondary metabolites may be the cause for its action against inflammation and bacterial infection in the wound.

Wound healing is a natural and complexed process which has many interconnecting steps for restoring the structural integrity to normal condition thus making the damaged area functional. Wound healing is divided into four phases like homeostasis, inflammation, proliferation and tissue remodelling[18]. An ideal wound healing agent should possess significant antibacterial activity to reduce the infection in the wound and anti-inflammatory property to reduce the inflammation and should also have proliferative and regenerative activity to enhance the process of proliferation of cells and remodelling of the tissue[19].

Curcumin present in *C.longa* has been used against wounds from the ages and recent studies also proved that it is effective in treating both kinds of wounds like acute and chronic[20]. Apart from having antibacterial potential[21], curcumin also shows significant antioxidant and anti-inflammatory activities and promotes proliferation of the tissue and remodelling, thus making it as healing agent which is highly potent. Recent studies reveals the importance of curcumin in every stage of wound healing process. Curcumin can prevent the generation of two cytokinins like interleukin-1(IL-1) and tumor necrosis factor alpha 9TNF-), which can cause inflammation[22].

It also decreases the expression of antioxidant enzymes, which can cause the inflammation and the process of oxidation[23]. Additionally, it also enhances the migration of fibroblast, granulation in tissue development, deposition of the collagen and re-epithelization for the improvement of proliferation. Further, by enhancing synthesis of TGF and proliferation of fibroblast, it also promotes remodelling of tissue and contraction of the wound[24].

F. bengalensis is a tree species belonging to Moraceae family. The aerial roots of this tree species are used in syphilis, biliousness, dysentery, inflammation of liver[25]. Methanol and ethanol extracts of aerial roots of *F. bengalensis* were sensitive against *Vibrio anguillarum* and *Enterococcus faecalis* showing a zone of inhibition up to 20 mm[26]. Studies to increase the height were carried out using the alcohol and aqueous extracts of young aerial roots of *F. bengalensis*, which is having growth promoting potential and extensively used by the tribal people belonging to western Zone of Maharashtra State, India for enhancing the height. The growth enhancing effect of *F. bengalensis* was assayed using female experimental rats of one month old. Alcohol and aqueous extracts, after being administered for 30 days showed a significant ($P<0.05$) enhancement in body weight among female rats. In another study animals treated with alcohol extract of *F.bengalensis* showed significant difference ($P<0.05$) in food consumption, total length of the body and enhanced alkaline phosphatase levels which is a biochemical marker for bone formation. The results justify the potency of plant material as well as use of *F.bengalensis* in growth promotion based on chronic studies[27].

The present traditional medicinal value of aerial parts of *T. purpurea*, powder of *C. longa* rhizome and fresh aerial roots of *F. bengalensis* against gangrene may be justified based on wound healing activity and anti-inflammatory activity of *T. purpurea*, *C. longa* and growth promoting activity of *F.bengalensis*. The overall efficacy of this herbal formulation may be due to the synergy of secondary metabolites present in these three medicinal plants.

3. Conclusion

Traditional herbal management consisting of *T. purpurea*, *C. longa* and *F. bengalensis* was found very useful and safe in the treatment of gangrene due to diabetes. The efficacy of the three medicinal plants may be due to wound healing and anti inflammatory effects of *T. purpurea*, *C. longa* and growth promoting activity of *F.bengalensis*. The findings of the present survey on this traditional usage of three medicinal plants suggest that, management of gangrene may be achieved without surgical intervention. Further, the findings have to be confirmed and validated by conducting clinical studies in more number of patients with gangrene.

4. Conflict of Interest:

The authors declare that there are no conflicts of interest.

5. Acknowledgements:

Authors are very much thankful to Sri Padmavati Mahila Visvavidyalayam (Women's University), Tirupati, A.P, India for providing us with facility in carrying out the present study.

References

1. Hedy Marks. Gangrene [Internet].2021. Available from: <https://www.webmd.com/skin-problems-and-treatments/guide/gangrene-causes-symptoms-treatments>.
2. Advancedamputees.com. Amputee statistics you ought to know [Internet].2014. Available from: <http://www.advancedamputees.com/amputee-statistics-you-ought-know>.
3. Kurichi JE, Bates BE, Stineman MG. Amputation [Internet].2010.Available from: <http://www.cirrie.buffalo.edu/encyclopedia/en/article/251/>
4. Cousins, N. Anatomy of an Illness as Perceived by the Patient. New York: Norton. *American Journal of Clinical Hypnosis*.1979; 26(1): 61–62.
5. Ertl JP, Brackett WJ, Ertl W, Pritchett JW, Calhoun J. Emedicine.medscape.com. [Internet].2014.Available from: <http://www.emedicine.medscape.com/article/1232102-overview>
6. World Health Organization.2008. Traditional medicine: Fact sheet N134 [Internet].2008. Available from: <http://www.who.int/mediacentre/factsheets/fs134/en/>
7. Chambliss LR. Alternative and Complementary Medicine: An Overview. *Clin Obstet Gynaecol*. 2001; 44:640–52.
8. Astin J, Marie A, Pelletier KR, Hansen E, Haskenn WL. A review of the incorporation of complementary and alternative medicine by mainstream physicians. *Arch Intern Med*.1998; 158:2303–10.
9. Cassileth B, Lusk E, Strouse T, Bodenheimer BJ. Contemporary unorthodox treatments in cancer medicine: A study of patients, practices, and practitioners. *Ann Intern Med*.1984; 101:105–12.
10. Cook C and Baisden D. 1986. Ancillary use of folk medicine by patients in primary care clinics in southwestern West Virginia. *South Med J*. 1986; 79:1098–101.
11. Millar W. Use of alternative health care by Canadians. *Can J Public Health*. 1997; 88:154–8.
12. Deshpande SS, Shah GB and Parmar NS. Anti-ulcer activity of *Tephrosia purpurea* in rats. *Indian Journal of Pharmacology*. 2003; 35(3), 168-172.
13. Sivaraajan VV and Balachandran I. Ayurvedic drugs and their plant sources. Oxford and IBH Publishing. 1994.
14. Akkol EK, Koca U, Peşin I, Yılmaz D, Toker G, Yeşilada E. Exploring the wound healing activity of *Arnebia densiflora* (Nordm.) Ledeb. By *in vivo* models. *Journal of Ethnopharmacology*. 2009; 124(1),137-141.
15. Khatri A, Garg A and Agrawal SS. Evaluation of hepatoprotective activity of aerial parts of *Tephrosia purpurea* L. and stem bark of *Tecomella undulata*. *Journal of ethnopharmacology*. 2009; 122(1),1-5.
16. Gokhale AB and Saraf MN. *Tephrosia purpurea*: a review of contemporary literature and medicinal properties. *Indian Drugs*. 2000; 37: 553–560.
17. Pelter A, Ward RS, Rao EV, Raju NR. 8-Substituted flavonoids and 3-substituted 7-oxygenated chalcones from *Tephrosia purpurea*. *J Chem Soc Perkin Trans*.1981; 1.;5:2491–2498. <http://dx.doi.org/10.1039/p19810002491>.

18. Tejada S, Manayi A, Daglia M, FNabavi S, Sureda A, Hajheydari Z, Gortzi O, Pazoki-Toroudi HM, Nabavi S. Wound healing effects of curcumin: A short review. *Curr. Pharm. Biotechnol.* 2016; 17,1002–1007.
19. Velnar T, Bailey T, Smrkolj V. The wound healing process: An overview of the cellular and molecular mechanisms. *J. Int. Med. Res.* 2009; 37, 1528–1542.
20. Salehi B, Rodrigues CF, Peron G, Dall’Acqua S, Sharifi-Rad J, Azmi L, Shukla I, Singh Baghel U, Prakash Mishra A, Elissawy AM. Curcumin nano formulations for microbial and wound healing purposes. *Phytother*, 2021; Res. 5, 2487–2499.
21. Krausz AE, Adler BL, Cabral V, Navati M, Doerner J, Charafeddine RA, Chandra D, Liang H, Gunther L, Clendaniel A. Curcumin-encapsulated nanoparticles as innovative antimicrobial and wound healing agent. *Nanomedicine.* 2015; 11,195–206.
22. Gong C, Wu Q, Wang Y, Zhang D, Luo F, Zhao X, Qian Z. A biodegradable hydrogel system containing curcumin encapsulated in micelles for cutaneous wound healing. *Biomaterials.*2013; 34, 6377–6387.
23. Pulido-Moran M, Moreno-Fernandez J, Ramirez-Tortosa C, Ramirez-Tortosa M. Curcumin and Health. *Molecules.*2016; 21, 264.
24. Bhandari PR. Garlic (*Allium sativum* L.): A review of potential therapeutic applications. *Int. J. Green Pharm.* 2012; 6, 118–129.
25. Govil JN, Singh VK, Shameema H. Glimpses in Plant Research. Medicinal Plants: New Vistas of Research (part 1). New Dehli, India, Today & Tomorrow’s Printers and Publishers.; 1993.
26. Verma VK, Sehgal N, Prakash O. Characterization and screening of bioactive compounds in the extract prepared from aerial roots of *Ficus benghalensis*. *Int. J. Pharm. Sci. Res.*2015; 6:5056. doi: 10.13040/IJPSR.0975-8232.6(12).5056-69.
27. Nidhiya SR, Pai KSR, Rao CM. Growth promoting potential of *Ficus benghalensis* root extracts in immature female rats. *J. Pharm. Biol.* 2009; 47(4): 268-273

Fig.1: Aerial roots of *Ficus benghalensis* L.



Fig.2: Habit of *Tephrosia purpurea* (L.) Pers.

