



REVIEW OF SOURCE PLANTS OF KSHARA FOR KSHARA SUTRA PREPARATION FOR THE MANAGEMENT OF FISTULA-IN-ANO

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ABSTRACT

Ksharasutra is a successful novel drug delivery system in managing cases of fistula-in-ano. Currently, the ksharasutra is prepared with Apamarga (*Achyranthes aspera*) kshara. Although this ksharasutra has been a landmark success, but naturally it has certain clinical problems like pain, burning sensation and itching associated with it. These problems can be attributed to different doshas. Ayurveda also postulates for different herbs for different individuals on basis of their constitution and doshic involvement of the clinical condition. Sushruta has enlisted 23 plants for source of kshara which have to be used together for kshara preparation. Sushruta has also laid a principle to take the practically available plants, whether all or some or even one, for preparing a formulation from the enlisted plants of a category. Therefore, there is a classical support to use one or few of the source plants for preparing kshara and a pharmacological possibility that these ksharas prepared out of different plant will behave differently. The incidence of itching in Apamarga ksharasutra is the least and this can be related to the predominant kapha shamaka action of Apamarga. Therefore, it is logical to hypothesize that kshara made out of a Vata shamaka plant may cause less incidence of pain and a kshara made out of a Pitta shamaka plant may cause less incidence of burning sensation. The article critically reviews the classical, contemporary views on kshara and its source plants, the already available information supporting the role of these plants in healing of fistula-in-ano with an objective to explore specific kshara sutra on basis of doshic involvement.

Keywords: Ksharasutra, Kshara, Kshara source plants, Fistula-in-ano

INTRODUCTION

Ayurveda recognises from the primitive time that certain clinical condition will require surgical intervention (shastrapranidhana) for complete or better cure. Charaka Samhita, predominantly a Kayachikitsa (Internal Medicine) treatise, has also stated that the diseases like gulma (abdominal gaseous tumours), arsha (haemorrhoids), bhagandar (fistula-in-ano), ashmari (calculi) may require surgical intervention.¹

Sushruta, the father of surgery has discussed in detail about various surgical methods and their importance in therapeutics. But the unique contribution of Sushruta and Ayurveda in the field of surgery is the concept of anushastra or parasurgical substances and procedures. An anushastra is defined as hinashastra (sub-surgical instrument) or shastra sadrushya (similar to a surgical instrument), that is any substance or procedure that can be used like a surgical instruments but with lesser invasion and stress on the patients. Sushruta has enumerated fourteen such anushastras, which include bamboo blade, crystal, agnikarma (cautery), jalaukavacharana (leech application) and kshara pranidhana (caustic application). These are to be used depending upon both patient and disease condition, specifically indicated in paediatric population, people who are afraid of surgical procedures and in the absence of surgical instruments.

Kshara or caustic substances is considered as one of the most important means of parasurgical means because kshara can produce excision, incision, scrapping and can pacify all three doshas. Kshara sourced from different plants are described in Ayurveda to be used in different

ways to manage various diseases, which includes many of the ano-rectal conditions like arsha (haemorrhoids), bhagandar (fistula-in-ano), nadi vrana (sinus).

The commonest drawback in management Ano-rectal disorders is their recurrence and therefore physicians from the ancient times have tried to manage these conditions in different ways. This is one segment for which maximum types of surgical, para-surgical and medicinal applications are described indicating the complexity of the condition. Kshara application and in the recent era modified kshara application in the form of ksharasutra in ano-rectal diseases has become a common practice in Ayurvedic surgical parlance. Ksharasutra is a novel drug delivery system in which a thread smeared with kshara (caustic substance) is applied to induce both mechanical and chemical cutting and healing. No direct reference of Ksharasutra is found in Sushruta for the treatment of fistula, but he as indicated a medicated thread in the treatment of Nadvrana.² Vagbhatta has described to use thread smeared with kshara in the treatment of nadi.³ Chakradatta has referred to a medicated thread coated with *Euphorbia nerifolia* and *Curcuma longa* powder in the treatment of arsha.⁴

Based on these clues Prof. Deshpande and Sharma through their pioneering work developed a modified ksharasutra for the management of fistula.⁵ This ksharasutra has become so popular that almost 90% the Ayurvedic surgical intervention is done through this. The efficacy and benefit of this ksharasutra is now well established. But, it has certain common problems like pain, burning sensation and itching⁶, which needs to be

attempted for minimisation. Although, an exhaustive list of kshara source plants is described in the Sushruta, mostly the kshara of apamarga (*Achyranthes aspera*) is used in ksharasutra preparation. Since the Prakriti (constitution) of the patients, dosha involvement in the clinical conditions would be different, accordingly different kshara source plants should suit individual patients because different source plants should exert different pharmacological behaviour. Further, availability and cost of plants are place and season specific and rationalization can happen through exploring different plant sources for kshara. It is, thus logical to explore the possibility and feasibility of using other kshara in preparation of ksharasutra through structured research programme. Some attempts has been made in this direction, but so far the efforts have been sporadic. Therefore this article is designed to compile information about plants which are described by Sushruta as Kshara source plants, particularly in reference to their possible role in clinical conditions which are routinely managed by ksharasutra.

Review of Ksharasutra

The preparation of ksharasutra comprises of two main steps

A- Preparation of kshara from source plants

B- Smearing of kshara on a thread to make ksharasutra

Preparation of kshara

Definition and Properties of Kshara

Kshara is defined as any substance whose can remove morbid tissues and can cleanse tissues and doshas. Kshara pacifies of all three doshas because it is prepared by using many source plants. Although it is saumya (mild), still it has cauterisation, disruption ability because it also contains source plants with ushna veerya. Owing to its katu rasa (pungent taste), ushna veerya and teekshna guna kshara facilitates transformation, purification, absorption, healing, scrapping and coagulation effects. Due to these properties it is beneficial in worm infestation, kaphadushti, skin diseases, toxins formation and obesity, whereas it can produce impotency if used internally in excess for a long time.²

Types of kshara

Sushruta has classified kshara into two types.

1) Pratisaraniya kshara (for external application)

2) Paaniya kshara (for internal use)

Both types of kshara have their own indications and precautions²

The application of ksharasutra is a modified form of Pratisaraniya kshara.

Kshara source plants

Sushruta has given a list of 23 plants for kshara preparation². (Table -1)

Table 1: List of source Plants of Kshara as per Sushruta Samhita

S. NO	Name	Botanical Name	Family
01	Mushkka	<i>Elaeodendron glaucum</i> Pers.	Celastraceae
02	Kutaja	<i>Holarrhena antidysentrica</i> Linn.	Apocynaceae
03	Palash	<i>Butea monosperma</i> Linn.	Fabaceae
04	Ashwakarna	<i>Dipterocarpus turbinatus</i> Gaertn.F.	Dipterocarpaceae
05	Paribhadrak	<i>Erythrina variegata</i> Linn.	Fabaceae
06	Bibhitaka	<i>Terminalia belerica</i> . Roxb.	Combretaceae
07	Aragvadh	<i>Cassia fistula</i> Linn.	Caesalpinoidae
08	Tilwaka	<i>Symplocos racemosa</i> Roxb.	Symplocaceae
09	Arka	<i>Calotropis procera</i> (Ait)R.Br.	Asclepiadaceae
10	Snuhi	<i>Euphoria nerifolia</i> Linn.	Euphorbiaceae
11	Apamarg	<i>Achyranthes aspera</i> Linn.	Amaranthaceae
12	Patla	<i>Stereospermum suaveolens</i> DC.	Bignoniaceae
13	Naktamal	<i>Pongamia pinnata</i> Pierre.	Fabaceae
14	Vrusha	<i>Adathoda vasica</i> Nees.	Acanthaceae
15	Kadali	<i>Musa Sapientum</i> Linn.	Musaceae
16	Chitraka	<i>Plumbago zeylanica</i> Linn.	Plumbaginaceae
17	Putika	<i>Holoptelia integrifolia</i> Planch	Ulmaceae
18	Asphota	<i>Hemidesmus indicus</i> R.Br	Asclepiadaceae
19	Ashwamarak	<i>Nerium indicum</i> Mill	Apocynaceae
20	Saptachhada	<i>Alstonia scholaris</i> R,Br	Apocynaceae
21	Agnimantha	<i>Premna mucronata</i> Roxb.	Verbenaceae
22	Gunja	<i>Abrus precatorius</i> Linn	Fabaceae
23	Koshataki	<i>Luffa acutangula</i> Roxb	Cucurbitaceae

Table 2: Division of Plants on the basis of their Doshaghatva

Vataghna	Kadali
Pittaghna	Aragvadh, Krutavedhan, Kutaja
Kaphaghna	Palash, Karanj, Tilvak, Vasa, Agnimanth, Apamarg, Snuhi, Putika, Ashwakarna, Nimba, Bibhitaka, Karavira, Arka, Saptachhada, Chitraka, Krishnamushkaka
Tridoshgna	Patala, Sariva, Gunja

All these plants have textual description as potential kshara dravya but each plant has its own Rasapanchaka. Thus, the resultant kshara could have different set of pharmacological properties and actions. Therefore, it is possible to use different ksharas in different patients to minimise the commonly encountered undesirable effects like pain, burning, itching, etc, while without

compromising the primary objective of managing fistula-in-ano.

Method of preparing pratisaraniya kshara

The source plants of kshara should be collected in autumn season from the foot hills or forest area. The collector should maintain personal hygiene and collection should be made from an ideal land and from a matured plant

source. The collector should offer prayers and do certain rituals to get the desired results from the kshara. All the five parts of a plant i.e. root, stem, flower, leaves and fruits should be collected and cut in to small pieces. These small plant pieces should be allowed to dry avoiding direct sun light. When completely dry, the plant pieces are kept on a clean pucca platform situated in an open place without exposure to direct wind. The pile of dry plant parts is put to fire on this platform and is allowed to burn completely. The remnant ash are allowed to cool down on its own and then collected in a clean vessel. Classically, it is advised to burn the plant parts with dried sesame plants and to throw lime stones in to the fire while burning. These burnt lime stones should be collected and kept separately to be used during the second stage. The collected ash is dissolved in six times of water. Even if Sushruta has advised cow urine as an alternate dissolving medium, but in context of ksharasutra and its application in fistula-in-ano cow urine is avoided because it is strongly teekshna and can cause irritation. The ash dissolved in six times water is allowed to settle down and the supernant fluid is collected and kept in a separate vessel. The residue is again mixed with six times water and the supernant part is collected. The fluid thus collected should be filtered is through a cloth for 21 times or through a bi-fold Whatman filter paper for two to three times. This resultant filtrate liquid is clean, free from any suspended material and brown in colour. This filtrate is known as ksharodaka. This ksharodaka is evaporated slowly on a moderate flame with continuous stirring taking care that the bottom part of kshara is not burn. When the liquid becomes thick like paste the flame is put off and the kshara is allowed to cool on its own. The resultant kshara is known as mridu kshara and is usually used in ksharasutra. This is white in colour and consists of brittle flakes which can be easily powered. Madhyam and tikshna kshara can be prepared by adding appropriate prativapya (strong alkaline substances like limestone, pearl shell etc) but since these are not used in ksharasutra they are not discussed here.²

Method of Kshara sutra preparation

The prepared kshara, snuhi ksheera (latex collected from *Euphorbia nerifolia*) and haridra (*Curcuma longa*) powder is smeared on no. 20 surgical thread. These materials are smeared on the thread as 21 coatings in following manner. Out of these twenty-one coatings eleven times smearing is done with snuhi ksheera followed by seven times with paste prepared out of snuhi ksheera and kshara and the remaining three coatings are done with paste made out of snuhi ksheera and haridra powder. Snuhi ksheera acts as a binder and since the kshara powder is an excessively hygroscopic material which can absorb moisture when left exposed to the atmosphere to become ineffective, the final three coatings of the latex and turmeric powder prevents direct contact of kshara coatings with the atmospheric air and therefore can be preserved and used for a long time. The thread is allowed to dry after each smearing and the next smearing is done after the thread is dry. This type of ksharasutra has been found to command the maximum efficacy.⁷

Mode of action of kshara sutra in fistula-in-ano

Ksharasutra has a multiple mechanism in healing the fistula track owing to the multiple medicaments presented with it. The thread itself acts as a mechanical and gradual cutter. The *E. nerifolia* latex smeared onto it produces debridement of tissue by way of the proteolytic enzymes present in it. The kshara dissolves fibrous tissues and helps in draining out the contents of the track to provide a conducive healing surface. *C. longa* has local antimicrobial and anti-inflammatory activity. All these activities play a role in simultaneous debridement, cutting and healing of the track.⁷

Common problems associated with ksharasutra management

Even if there is no organized collective data available to indicate the incidence rate of commonly associated clinical problems during and after ksharasutra application, but reports of various studies reveal the most common problems as of ksharasutra application as pain, itching and burning.

Properties and Actions of Kshara Source Plants

A compiled review of pharmacological properties, actions and recent findings in reference to wound healing is presented below.

KRISHNAMUSHKAKA

Botanical source - *Elaeodendron glaucum* Pers.

Family - Celastraceae

Morphology - A small tree

Habitat - In most of the parts of India

Attributes

Rasa - Katu, Tikta Veerya - Ushna

Vipaka - Katu Doshghanata - Kaphavataghna⁸

PALASH

Botanical source - *Butea monosperma*. Ham.

Family - Fabaceae

Morphology - A tree 13 to 15 meters tall with 1.5 to 2 meters girth at the base, flowering in the spring and fruting in summer.

Habitat - All over India

Attributes

Rasa - Tikta, katu, kashaya Vipaka – Katu⁹

Gunas - Sara, Snigdha Veerya - Ushna

Doshagnata - Flowers- Kaphapittaghna, Aggravates Vata⁸

External uses

1) Bark decoction used for pariseka in vrana, arsha.

2) Leaf and flower being shothahara and vedanasthapana.¹⁰

Recent studies

1) The alcoholic bark extract accelerated wound healing in full thickness excised rats.¹¹

2) The aqueous and alcoholic extracts of *B. monosperma* significantly increased wound contraction, epithelialization time, tensile strength, hydroxyproline content and granuloma weight in incised and excised wound of rats. The granulation tissue weight and hydroxyproline content in the dead space wounds were also increased significantly in treated animals compared with control.¹²

3) Plant is being used for treatment of wounds and burns by tribals and folklore practiced areas in India.¹³

ARAGVADHA

Botanical source - *Cassia fistula* Linn.

Family - Fabaceae

Morphology - 8 to 10 meters tall tree

Habitat - All over India

Attributes

Rasa-Madhura Vipaka- Madhur⁹

Veerya- Sheeta Gunas- Guru

Doshagnata- Pittaghna⁸

External uses

1) Alcoholic extract of *cassia fistula* Linn. leaves showed better wound closure, improved tissue regeneration at the wound site and supporting histopathological parameters pertaining to wound healing.¹⁴

2) Plant is being used for treatment of wounds and burns by tribals and folklore practiced areas in India.¹³

Recent studies

1) Alcoholic extract of *cassia fistula* Linn. leaves showed better wound closure, improved tissue regeneration at the wound site and supporting histopathological parameters pertaining to wound healing.¹⁴

2) Plant is being used for treatment of wounds and burns by tribals and folklore practiced areas in India.¹³

KARANJ (Naktamal)

Botanical source - *Pongamia glabra* Vent.

Family - Fabaceae

Morphology - 25 to 50 feet tall trees, flowering in May and June fruitation in Dec and January.

Habitat - Central and Eastern Himalayas up to 1300 meters and in the costal region of South India.

Attributes

Rasa- Katu Vipaka- Katu

Gunas- Laghu and Teekshna Veerya- Ushna

Doshagnata- kaphavataghna⁸

External uses

1) Bark and leaves-germicidal and antipruritic.

2) Seed oil-germicidal clenses and heals wounds.

3) Paste of leaves is useful in vranashotha.¹⁰

Recent studies

1) The Juice of leaves of *Pongamia pinnata* applied on the wound.¹⁵

2) In ethanobotanical study of Tirunelveli hills in Southern India plant is being used on wounds & related injuries such as cuts, burns, bruises caused by external injury, boil, sores, abscess.¹⁶

TILVAK

Botanical source - *Symplocos racemosa* Roxb.

Family - Symplocaceae.

Morphology - A medium sized evergreen tree.

Habitat - North east India and upto chhota Nagpur in Bihar and Malbar.

Attributes

Rasa- Kashaya Vipaka- katu⁹

Gunas- Laghu Veerya- Sheeta

Doshagnata- kaphaghna, pittaghna⁸

External uses

1) Paste applied in shotha, kushta, bleeding and infected wounds.

2) Vranashodhana-ropana and contracts blood vessels.¹⁰

Recent Studies

1) *Symplocos racemosa* showed wound healing activity effectively in experimental models.¹⁷

2) In ethnobotanical survey of Jalgaon District of Maharashtra (India) Plants was used as wound healing remedy.¹⁸

PATALA

Botanical source - *Stereospermum suaveolens* DC.

Family - Bignoniaceae

Morphology - Tree about 10 to 20 meters tall, flowering in greeshma ritu and fruition in winter.

Habitat - Growing in marshy places of Bihar, Bengal, Himalayan Tarai, Tamilnadu and Kerala.

Attributes

Rasa- Tikta, Kashaya Vipaka- katu

Gunas- Laghu, ruksha Veerya- Anushna

Doshagnata- Tridoshara⁸

External uses

1) Paste of leaves applied on wounds being vedanasthapana and vranaropana.

2) Paste of seeds be used in hemicrania.¹⁰

VASA (Vrisha)

Botanical source - *Adathoda vasica*. Nees

Family - Acanthaceae

Morphology - A thick shrub about 1 to 3 meters tall, flowering in Feb to March.

Habitat - All over India upto a height of 1.5 thousand

Attributes

Rasa- Tikta, Kshaya Vipaka- Katu

Gunas- Laghu Veerya- Sheeta

Doshagnata- kaphapittaghna, vatacara.⁸

External uses

1) Leaf paste is vedanasthapana and shothahara.

2) Leaf juice is disinfectant.¹⁰

Recent studies

1) The methanolic extract ointment of *Adhatoda vasica* showed a significant effect in excision wound model as comparable to standard drug and other two other extracts of ointment.¹⁹

2) Methanolic extract of *A.vasica* leaves showed remarkable wound healing activity with the ointment formulation at 1% concentration as compared to ethanol, ethyl acetate, chloroform and hexane extract of leaves of *A. vasica* in mice as a preclinical study.²⁰

AGNIMANTHA

Botanical source - *Premna mucronata*. Roxb.

Family - Verbenaceae

Morphology - Trees about 8 to 10 metres tall, flowering in April-May, fruition in May-June.

Habitat - U.P, Bihar, Bengal, on banks of Ganges, in hilly region from Kumaun to Bhutan, Sahyadri ranges and Konkan.

Attributes

Rasa- Tikta, Katu, Kashaya, Madura Veerya- Ushna

Gunas - Ruksha, Laghu Vipaka- Katu⁹

Doshagnata- kaphavataghna⁸

External uses

Leaves are Shotha and shoolahara.¹⁰

Recent studies

In ethnobotanical survey of Jalgaon District of Maharashtra (India) this plant was listed as a wound healing remedy.¹⁷

APAMARGA

Botanical source - *Achyranthes aspera* Linn.

Family - Amaranthaceae

Morphology - An herb about 0.33 to 1 meter tall with branched or Un- branched stem. Flowering and frutition in winter fruit Ripens and dehisces in Greeshma ritu.

Habitat - All over India in dry land

Attributes

Rasa- Katu, Tikta Vipaka- Katu

Gunas- Tikshna Veerya- Ushna⁹

Doshagnata- Kaphavataghna⁸

External uses

1) Kshara is used in urdhwajatrugatarogas.

2) Decoction is used as abisheka in kandu and pitika.¹⁰

Recent studies

1) The aqueous extracts of leaves of *Achyranthes aspera* was found to be more effective for its wound healing activity as compared to ethanolic extract.²¹

2) *A. aspera* Linn. leaf extract showed significant ($P < 0.001$) wound-healing activity when compared with control and was as effective as soframycin (standard cream for comparison).²²

SNUHI

Botanical source - *Euphorbia neriifolia* Linn.

Family - Euphorbiaceae

Morphology - A fleshy shrub or tree about 3 – 6 meters tall.

Habitat - All over India and Bhutan

Attributes

Rasa- Katu Vipaka- Katu⁹

Gunas- Guru, Tikshna Veerya- Ushna

Doshagnata- kaphavataghna.⁸

External uses

1) Leaf and stem are used as vedanasthapan.

2) Ksheera is used as lepa on arshankuras.¹⁰

Recent studies

1) Hydroalcoholic extract of *E. neriifolia* leaf showed wound healing activity on rat.²³

2) Topical application of 0.5% and 1.0% sterile aqueous solution of the aq. Extract of the latex of *Euphorbia nerifolia* facilitates wound healing process by increasing epithelisation, angiogenesis, tensile strength and DNA content in surgically produced cutaneous wound of guinea pig.²⁴

3) Plant is being used for treatment of wounds and burns by tribals and folklore practiced areas in India.¹³

CHIRABILWA (Putika)

Botanical source - *Holoptelia integrifolia* Planch.

Family - Ulmaceae

Morphology - 25 to 50 feet tree, Flowering in Feb to March and frutition after flowering.

Habitat - All over India

Attributes

Rasa- Tikta, kashaya Gunas- Laghu, Ruksha⁹

Veerya- Ushna Vipaka- Katu

Doshagnata- kaphaghna⁸

External uses

Paste of bark is useful in oedema.¹⁰

Recent studies

The methanolic extracts of *Holoptelea integrifolia* (Roxb.) leaves and stem bark showed wound healing activity by higher breaking strengths and higher

hydroxyproline content suggested higher collagen re-deposition.²⁵

KRUTAVEDHANA

Botanical source - *Luffa acutangula* (Linn.) Roxb.

Family - Cucurbitaceae

Morphology - A creeper

Habitat - All over India

Attributes

Rasa- Madura Gunas- Laghu, Ruksha, Teekshna.

Veerya- Sheeta Vipaka- Katu⁹

Doshagnata- Aggrevate kaphavatta and Pittaghna.⁸

Recent studies

Methanolic extract of fruit showed significant antiproliferative activity on human lung adenocarcinoma epithelial cell line.²⁶

KUTAJA

Botanical source - *Holarrhena antidysentrica* Linn.

Family - Apocynaceae

Morphology - Trees of 9-12 meters, whitish smoky bark, flowering in May – June, fruiting in winter

Habitat - All over India upto 1.5 thousand meters

Attributes

Rasa- Katu, Kashaya Vipaka- Katu⁹

Gunas- Ruksha Veerya- Sheeta

Doshagnata - Pittarakatakaphaaghna⁸

External uses

1) Vranaropana.

2) Its decoction should be used in dressing of wounds.¹⁰

Recent studies

1) In ethnobotanical survey of Jalgaon District of Maharashtra (India) Plants was used as wound healing remedy.¹⁸

2) Plant is being used for treatment of wounds and burns by tribals and folklore practiced areas in India.¹³

ASHWAKARNA

Botanical source - *Dipterocarpus turbinatus* Gaertn. f.

Family - Dipterocarpaceae

Morphology - Big tree grows upto 40 meters, stem bark is 2.5 - 5 cm thick,

Habitat - East India and Islands of Andaman

Attributes

Rasa- katu, Tikta²⁷ Vipaka- Katu

Gunas- Laghu, Snigdha Veerya- Ushna

Doshagnata- Kaphavataghna.⁹

Recent studies

Its oleo resin is used in ulcer as local application²⁸

NIMBA

Botanical source - *Azadirachta indica*. A. Juss.

Family - Meliaceae

Morphology - Trees up to 14 to 16 meters with smoky black bark red from inside, flowering in March-April and fruiting in July.

Habitat - All over India especially in north and western India

Attributes

Rasa- Tikta Vipaka- Katu

Gunas- Laghu Veerya- Sheeta

Doshagnata- Kaphapittaghna⁸

External uses

1) Varanashodana

2) Nimba taila is used in treating infected wounds and diabetic ulcer.¹⁰

Recent studies

Plant is being used for treatment of wounds and burns by tribals and folklore practiced areas in India.¹³

BIBHITAK

Botanical source - *Terminalia bellirica*. Roxb.

Family - Combretaceae

Morphology - Trees 20-26 meters tall, stem straight hard and dark Brown, flowering in May and fruiting after an year

Habitat - All over India specially in lower hilly regions

Attributes

Rasa- Kashaya Vipaka- Madura

Gunas- Ruksha, Veerya- Ushna

Doshagnata- kaphapittaghna⁸

External uses

- 1) Shothahara and Vedanasthapna
- 2) Paste of fresh fruit or seed oil is used in odema and Pain
- 3) Dry powder is used in traumatic wound.¹⁰

Recent studies

1) In ethanobotanical study of Tirunelveli hills in Southern India plant is being used on wounds & related injuries such as cuts, burns, bruises caused by external injury, boil, sores, abscess.¹⁶

2) The ethanolic extract of *Terminalia bellirica* Roxb. fruit showed significant response on excision and incision wound model, in albino rats, in the form of an ointment with two concentrations (2 and 4% w/w ointment).²⁹

KARAVIRA

Botanical source - *Nerium indicum*. Mill

Family - Apocynaceae

Morphology - Shrub about 3 meters tall, flowering in June-July and fruiting in Winters.

Habitat - All over India upto 2000 meters height

Attributes

Rasa- Tikta, Kashya, katu Vipaka- Katu
Veerya- Ushna Gunas- Laghu, ruksha, teekshna.⁹

Doshagnata- kaphavataghna.⁸

External uses

- 1) Varanashodhna, Varanaropana and Shothahara.
- 2) Used in ulcers due to syphillitis.
- 3) Leaf paste should be applied to piles and wounds.¹⁰

Recent studies

Juice of the leaves of *Nerium indicum*. Mill showed wound healing activity.⁹

ARKA

Botanical source - *Calotropis procera*. [Ait], R. Br.

Family - Asclepiadaceae

Morphology - Shrub grows upto 1-2 meters, flowering in March- April and fruiting in June.

Habitat - Dry and arid land all over India

Attributes

Rasa- Katu, Tikta Vipaka- Katu

Gunas- Laghu, Ruksha, Teekshna Veerya- Ushna

Doshagnata- Kaphavataghna⁸

External uses

- 1) Varanashodhana, Shothahara and Vedanasthapna.
- 2) Warm leaves applied to oedematous parts.
- 3) Decoction is used for dressings cleanses wounds removing kleda and krimi.¹⁰

Recent studies

1) In ethanobotanical study of Tirunelveli hills in Southern India plant is being used on wounds & related injuries such as cuts, burns, bruises caused by external injury, boil, sores, abscess.¹⁶

2) Latex of *Calotropis procera* enhanced the wound healing process on four full thickness excisional wounds of 8.0 mm diameter were inflicted on the back of guinea pigs twice daily for 7 days.²⁶

3) Plant is being used for treatment of wounds and burns by tribals and folklore practiced areas in India.¹³

SARIVA

Botanical source - *Hemidesmus indicus*. R. Br.

Family - Asclepiadaceae

Morphology - A twining creeper about 1.5-3 meters tall, flowers green from outside and brinjal coloured from inside, roots and stem redish from outside and white inside

Habitat - All over India

Attributes

Rasa- Madhur Vipaka- Madhur

Gunas- Guru, Snigdha Veerya- Sheet⁹

Doshagnata- Tridoshaghna⁸

External uses

Dahaprashman and Shothahara.¹⁰

Recent studies

In ethnobotanical survey of Jalgaon District of Maharashtra (India) Plants was used as wound healing remedy.¹⁸

SAPTAPARNA (Saptachhada)

Botanical source - *Alstonia scholaris*. R. Br.

Family - Apocynaceae

Morphology - Tree 13-16 meter tall, bark white from outside and yellow Inside, flowering in October and fruiting in winter.

Habitat - In Himalaya upto 1000 meters height, Bengal and Western ghats.

Attributes

Rasa- Kashya Vipaka- Katu⁹

Veerya- Ushna Gunas- Snigdha

Doshagnata- Kaphavataghna⁸

External uses

- 1) Varanashodhana, Varanaropana.
- 2) Decoction is used for dressing of wounds.¹⁰

Recent studies

1) The latex of *Alstonia scholaris* R.br showed wound healing activity.³¹

2) In ethnobotanical survey of Jalgaon District of Maharashtra (India) Plants was used as wound healing remedy.¹⁸

CHITRAKA

Botanical source - *Plumbago zeylanica*. Linn.

Family - Plumbaginaceae

Morphology - Small perinnial herb about 0.5-1 meter tall, flowering from Sept - Nov and fruiting after that.

Habitat - White variety grows abundantly in Bengal, U.P, South India

Attributes

Rasa- Katu Vipaka- Katu

Gunas- Laghu, Ruksha, Veerya- Ushna

Doshaghna- Kaphavataghna⁸

External uses

Lekhana and Visphotajanana.¹⁰

Recent studies

Plant is being used for treatment of wounds and burns by tribals and folklore practiced areas in India.¹³

GUNJA

Botanical source - *Abrus precatorius*. Linn.

Family - Fabaceae

Morphology - A Shrubby creeper, root and leaves are sweet in taste, flowering in Nov and fruiting in Jan.

Habitat - All over India over 12000 meters

Attributes

Rasa- Tikta, Kashya Vipaka- Katu

Gunas- Laghu, Ruksha, Tikshna Veerya- Ushna

Doshaghna- Seed- Kaphavataghna, Leaf- Tridoshghna⁹

External uses

1) Vedanasthapana and Varanaropana.

2) Paste should be applied to Vranashotha¹⁰

Recent studies

1) In ethnobotanical survey of Jalgaon District of Maharashtra (India) Plants was used as wound healing remedy.¹⁸

2) Plant is being used for treatment of wounds and burns by tribals and folklore practiced areas in India.¹³

KADALI

Botanical source - *Musa Sapientum* Linn.

Family - Musaceae

Morphology - Made up of bunch of petioles on a above the other 2-4 meter tall.

Habitat - All over India in marshy places

Attributes

Rasa- Madura, Vipaka- Madhura

Gunas- Guru, Snigdha Veerya- Sheeta

Doshaghna- Vatapittaghna and aggravates kapha⁸

External uses

1) Paste of fruit pulp, leaves and stem should be applied on burns.

2) Kadali kshara should be applied on sidhmakustha.¹⁰

Recent Studies

1) Both aqueous and alcoholic extracts (100mg/kg) showed increase in wound breaking activity and level of superoxide dismutase and reduced glutathione in the granulation tissue in compare to control group.³²

2) The 4% gel obtained from unripe banana peel (G4%) resulted in better epithelialization of wounds healed by secondary intention compared with other gel concentrations.

DISCUSSION

Fistula-in-ano and other ano-rectal conditions are difficult cases to manage owing to their high rate of recurrence. In this segment, Ksharasutra has been able to catch the imagination of contemporary surgeons belonging to both Ayurveda and modern surgery to offer a better and alternate method of management. This is one of the most prominent success stories wherein taking a clue from the classics, a novel drug and drug delivery system has been devised. There is no doubt ksharasutra has benefited a lot of patients and its effectiveness in the management of fistula-in-ano is well established but it is logical to

explore innovations and improvements in order to maximize effectiveness and minimize undesirable effects.

A critical analysis of kshara described by Sushruta and other classical authors like Chakradatta vis-à-vis the contemporary methodology of ksharasutra preparation reveals a distinct shift in approach. Sushruta has advised to use ingredients of all the 23 source plants of kshara to prepare kshara. The commentaries suggest 2 types of composition of source plants of kshara. One, Krishna Mushkaka should be 50% and other plants form the rest 50%. The other method suggests all plants should be taken in equal quantity. But there is unanimity in using all the source plants in preparation of kshara. The classical kshara was described as tridoshaghna and described to have katu rasa with lavana anurasa because they are prepared from so many plants. Although Sharma S. K. et al has stated that the source plants have no role to play in expression of the rasa of the resultant kshara and its action on doshas,⁷ but Sushruta's view seems to be different as he has clearly stated that kshara pacifies three doshas due to its various component plants.² Logically, albeit the source plants are burnt but their initial chemical and pharmacological behaviour could influence the ultimate composition of the kshara. In other words kshara prepared out of apamarga and kshara prepared from the combination of all source plants or any other individual source plant should have different chemical and pharmacological actions. An analysis of the source plants described by Sushruta reflects their different rasa and dosha action. (Table 2) The commonly used apamarga kshara pacifies kapha and the incidence rate of itching in ksharasutra application cases is comparatively lower. From Dravyaguna point of view the source plants will definitely influence the end products. Therefore it is quite possible that kshara made out of a vata shamaka plant like kadali should produce less pain and kshara made out of pitta shamaka plant like kutaja should produce less burning sensation.

Table 3: Common Problems Associated with Fistula-In-Ano on the basis of Dosha Predominance

Vataj	Ruja
Pittaj	Daha
Kaphaj	Srava, Kandu

The commonly seen problems associated with ksharasutra application can be classified on basis of dosha involvement (Table 3) and accordingly different source plants based on their dosha shaman activity can be tried on patients categorised on basis on their dosha prakriti.

A preliminary review of the ayurvedic pharmacological actions and contemporary researches done on the various kshara source plants show wound healing, anti-inflammatory, antimicrobial activity shown by many of these plants. These activities up to a large extent explain the efficacy of ksharasutra. This gives a scientific basis to explore different kshara source plants for ksharasutra application.

Rational selection of drug depends upon the prakriti of the patient and dosha involvement of the disease e.g. in Vataj prakriti and with symptoms like ruja (pain) a vata shamaka plant is preferred, in Pittaja prakriti and with symptoms like daha, raktata, visragandha (burning,

redness, foul smell) a pitta shamaka palnt is preferred, in Kaphaj prakriti and with symptoms like kandu, srava, sarambh (itching, secretions, inflammation) a Kapha shamaka plant is preferred and in tridoshaja prakriti and symptoms a tridosha shamaka plant is preferred. Among the above mentioned drugs each drug having different action on doshas unlike other. It is, thus logical to explore the possibility and feasibility of using kshara in this rationale in preparation of ksharasutra to assess their efficacy.

CONCLUSION

The above collection reveals almost all the plants can produce kshara whose are pharmacologically similar to apamarg kshara. Each plant has its own advantage in terms of geographical occurrence, feasibility of pharmaceutical processing, drug-patient interaction and user suitability. Although sporadic evidence is available for their clinlcal use, a structured research programme involving each drug should be planned to conduct trial and explore the practical differences among them. This will establish prescription guidelines for using ksharasutra vis-à-vis different patient and clinical conditions.

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