

**RASA-SHAstra–SHALYA TANTRA INTERFACE IN
CONTEMPORARY AYURVEDIC SURGERY: A CRITICAL
EVIDENCE SYNTHESIS OF PHARMACEUTICAL
STANDARDIZATION, KSHARA-BASED PARASURGICAL
INTERVENTIONS, RASAUSHADHI AND POSTOPERATIVE
THERAPEUTICS**

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ABSTRACT

Rasa-Shastra and Shalya Tantra represent two specialized domains of Ayurveda with potentially complementary roles in clinical practice. Shalya Tantra encompasses surgical and parasurgical procedures, wound management and postoperative care, whereas Rasa-Shastra deals primarily with the pharmaceutical processing and therapeutic application of metals, minerals and potent herbo-mineral preparations. Their interface is particularly relevant to Kshara karma, Kshara Sutra therapy, anorectal disorders and selected aspects of wound management. This narrative review examines classical concepts and contemporary clinical evidence concerning Kshara, Kshara Sutra, Bhagandara, Arsha, Parikartika and postoperative care, together with pharmaceutical standardization and safety considerations of Rasa-Shastra preparations. Published clinical studies have evaluated Kshara Sutra in fistula-in-ano, Apamarga Kshara in first- and second-degree hemorrhoids and

Kshara Sutra-based interventions in chronic fissure-in-ano. Evidence indicates potential

clinical utility of selected Ayurvedic parasurgical procedures, but outcomes differ according to disease anatomy, comparator and treatment objective. Modern analytical studies have additionally demonstrated the importance of batch standardization and safety evaluation of herbo-mineral preparations. An integrated approach should therefore be individualized according to diagnosis, anatomy, disease severity, procedural indication, pharmaceutical quality, patient preference and safety. Rasaushadhi should not be regarded as routinely necessary after every surgical procedure; rather, its use should be indication-specific and supported by appropriate pharmaceutical and clinical evidence. Future research should combine classical pharmaceutical principles with contemporary analytical science, randomized clinical trials, long-term follow-up and standardized surgical outcomes.

KEYWORDS: Rasa-Shastra, Shalya Tantra, Kshara, Kshara Sutra, Rasaushadhi, Bhagandara.

INTRODUCTION

Ayurveda contains specialized disciplines dealing with different aspects of health and disease. Among them, Shalya Tantra occupies a distinctive position because of its systematic description of surgical and parasurgical procedures, management of wounds, foreign bodies, ulcers and anorectal disorders. Classical surgical literature describes procedures including Chedana, Bhedana, Lekhana, Vedhana, Eshana, Aharana, Visravana and Sīvana, together with Agnikarma and Kshara karma.^[1]

Rasa-Shastra is a specialized pharmaceutical discipline concerned with the processing and therapeutic utilization of metals, minerals and selected herbo-mineral substances. Classical pharmaceutical procedures include Shodhana, Bhavana, Marana and formulation-specific processing methods. Rasatarangini and other Rasa-Shastra texts provide detailed descriptions of pharmaceutical processing and quality assessment.^[2]

The relationship between these disciplines becomes clinically relevant when surgical management is viewed as a continuum rather than as an isolated operative event. A patient undergoing a surgical or parasurgical procedure may require preoperative assessment, definitive intervention, local wound care, pain management, nutritional and metabolic optimization, treatment of infection when indicated and follow-up for healing and recurrence. Kshara represents a particularly important bridge between pharmaceutical preparation and Shalya Tantra. Classical surgical literature describes Kshara karma as a parasurgical

intervention, while Kshara Sutra has subsequently been clinically investigated, particularly in Bhagandara or fistula-in-ano.^[1]

The evidence base has expanded from classical descriptions to clinical trials. A multicentric randomized controlled clinical trial conducted under the Indian Council of Medical Research evaluated Kshara Sutra in 502 patients with fistula-in-ano^[3] Subsequent comparative research has examined Kshara Sutra against fistulotomy, while clinical trials have evaluated Apamarga Kshara in hemorrhoidal disease and Kshara Sutra-based interventions in chronic fissure-in-ano.^[4-7]

At the pharmaceutical level, modern analytical studies have demonstrated the importance of characterization and standardization of Rasa-Shastra formulations. Analytical investigation of Ras-family products has demonstrated variability in mercury, lead and arsenic concentrations between products and manufacturers.^[8] Similarly, characterization of Mahalaxmi Vilas Rasa demonstrated the applicability of modern physicochemical, elemental, HPTLC and X-ray diffraction techniques to traditionally prepared herbo-mineral formulations.^[9]

The present review therefore examines Rasa-Shastra and Shalya Tantra as complementary but distinct domains, with particular emphasis on clinically relevant parasurgical procedures, anorectal disease, postoperative care, pharmaceutical standardization and safety.

AIM

To review the conceptual, pharmaceutical and clinical relationship between Rasa-Shastra and Shalya Tantra, with particular reference to Kshara, Kshara Sutra, anorectal disorders, wound management and individualized postoperative therapy.

OBJECTIVES

To describe the classical relationship between Rasa-Shastra and Shalya Tantra.

To review the pharmaceutical and parasurgical basis of Kshara and Kshara Sutra. To evaluate available clinical evidence concerning Kshara Sutra in fistula-in-ano. To review the clinical application of Kshara in hemorrhoids and fissure-in-ano.

To discuss the potential role and limitations of Rasaushadhi in surgical patients.

To discuss pharmaceutical standardization and safety of herbo-mineral formulations. To propose an integrated, indication-based clinical framework.

To identify future research priorities.

MATERIALS AND METHODS

This article is a narrative review of classical Ayurvedic literature and contemporary scientific literature.

Classical concepts relating to Shalya Tantra, Kshara, Bhagandara, Arsha, Parikartika, Vrana and Rasa-Shastra were reviewed from standard Ayurvedic texts.

Contemporary literature was searched using PubMed/PubMed Central and relevant indexed literature using combinations of the terms: “Rasa-Shastra”, “Rasaushadhi”, “Bhasma”, “herbo-mineral formulation”, “Kshara”, “Kshara Sutra”, “fistula-in-ano”, “hemorrhoids”, “fissure-in-ano”, “wound healing”, “Ayurvedic surgery”, “postoperative management”, “heavy metals” and “pharmaceutical standardization”.

Clinical trials, comparative studies, systematic reviews, analytical investigations and toxicological studies were considered.

Classical descriptions were interpreted as traditional Ayurvedic concepts, while clinical efficacy claims were based on published contemporary evidence wherever available.

SHALYA TANTRA AS A SURGICAL SCIENCE

Shalya Tantra provides an extensive conceptual and procedural framework for the management of surgical diseases.

The classical surgical approach includes assessment of the disease, selection of the appropriate procedure, removal or control of pathological tissue, management of the wound and postoperative care.^[1]

This can be represented conceptually as

Diagnosis → anatomical assessment → disease staging → selection of procedure → definitive intervention → wound management → healing → follow-up.

The principle of selecting an intervention according to the anatomical and pathological characteristics of the disease remains highly relevant to contemporary surgery. In modern surgical practice, treatment selection similarly depends upon disease anatomy, severity, associated pathology, comorbidities and functional considerations.

RASA-SHAstra AS A PHARMACEUTICAL SCIENCE

Rasa-Shastra deals with specialized pharmaceutical processing of metals, minerals and selected medicinal substances.

Important classical pharmaceutical processes include.

Shodhana

Shodhana is a substance-specific pharmaceutical processing procedure. It should not automatically be equated with complete modern toxicological “detoxification”; its effects require formulation-specific analytical evaluation.

Bhavana

Bhavana involves wet trituration with a prescribed liquid medium and may influence the physicochemical characteristics of the processed material.

Marana

Marana is a classical process employed in the preparation of selected Bhasma.

Bhasma Pariksha Classical texts describe characteristic tests for assessing the properties of finished Bhasma.

Modern analytical methods can complement these traditional assessments through elemental analysis, phase characterization, particle-size analysis, spectroscopy and other techniques.

RASA-SHAstra AND KSHARA: DIFFERENT BUT INTERCONNECTED CONCEPTS

Kshara should not simply be equated with Rasa-Shastra.

Kshara primarily represents a distinct pharmaceutical and therapeutic concept within Ayurveda, while Rasa-Shastra is a specialized branch involving metals, minerals and herbo-mineral preparations.

Their clinical interface may be understood as.

Rasa-Shastra → pharmaceutical science

Kshara Kalpana → alkaline/caustic pharmaceutical preparation Shalya Tantra → therapeutic surgical/parasurgical application

Therefore, Kshara karma may demonstrate the pharmaceutical–surgical interface without implying that all Kshara preparations are Rasa-Shastra formulations.

Kshara KARMA Kshara karma is an important parasurgical intervention described in Ayurvedic surgical literature.

Kshara is traditionally classified into Paniya and Pratisaraniya forms according to mode of administration and application.^[1]

The classical actions attributed to Kshara include tissue-destructive and scraping effects,

described in terms such as Chedana, Bhedana, Lekhana and Patana.^[1]

From a contemporary conceptual perspective, local Kshara application may be compared with controlled chemical tissue destruction. However, this is a conceptual correlation and does not establish complete biomedical equivalence.

Clinical application should consider.

indication, disease stage, anatomical site,

strength of preparation, duration of application,

protection of surrounding tissue, postoperative wound care and patient-specific factors.

PANIYA KSHARA

Paniya Kshara refers to internally administered alkaline preparations described in Ayurvedic therapeutics.

In an integrated surgical framework, internal Kshara should not be prescribed simply because a patient has undergone an operation.

The rational sequence is.

Diagnosis → indication → formulation → dose → duration → monitoring.

The pharmaceutical characteristics and systemic safety of a particular preparation must be considered before clinical use.

PRATISARANIYA KSHARA

Pratisaraniya Kshara is intended for local application to selected pathological tissue.

Its classical therapeutic concept involves controlled local action on abnormal tissue. Apamarga Kshara has been clinically evaluated in first- and second-degree hemorrhoidal disease. Shah and Dudhamal conducted an open-label randomized controlled clinical trial involving 50 patients, with 25 patients in each group, comparing Apamarga Kshara application with sclerotherapy.^[5]

The study reported favorable improvement in bleeding and reduction of prolapse with Apamarga Kshara application.^[5]

However, the study was relatively small and open-label. Consequently, the results should be interpreted as supportive clinical evidence rather than definitive proof of superiority over contemporary treatment options.

KSHARA SUTRA: THE PHARMACEUTICAL–PARASURGICAL INTERFACE

Kshara Sutra represents one of the clearest examples of the interaction between pharmaceutical preparation and Shalya Tantra.

The commonly described classical Kshara Sutra involves a thread coated repeatedly with Snuhi latex, Apamarga Kshara and Haridra.^[1]

The procedure combines

mechanical action of the thread, local pharmaceutical action, gradual tissue division and wound-healing processes.

Kshara Sutra is sometimes compared with a medicated seton in modern surgical terminology. However, the two should not automatically be considered identical because the materials, preparation, pharmaceutical coating and intended mechanism may differ.

KSHARA SUTRA IN FISTULA-IN-ANO

Bhagandara is one of the most important areas in which Shalya Tantra and Kshara-based therapy intersect.

The multicentric randomized controlled clinical trial conducted under the Indian Council of Medical Research included 502 patients with fistula-in-ano.^[3]

Complete healing was reported in all 265 patients in the Kshara Sutra group and all 237 patients in the conventional-surgery group.^[3]

The median healing time was approximately 8 weeks in the Kshara Sutra group compared with 4 weeks in the conventional-surgery group.^[3]

At one-year follow-up, recurrence was reported as 4% in the Kshara Sutra group and 11% in the conventional-surgery group.^[3]

These findings provide substantial historical clinical evidence for Kshara Sutra but should be interpreted in the context of the study period, surgical techniques available at that time and contemporary emphasis on anatomical classification and sphincter preservation.

Kshara Sutra VERSUS FISTULOTOMY Dutta et al. conducted a prospective randomized comparative study involving 50 patients, with 26 patients treated with Kshara Sutra and 24 with fistulotomy.^[4]

The study included predominantly intersphincteric and transsphincteric fistulae.^[4]

Mean healing time was 53 days with Kshara Sutra compared with 35.7 days following fistulotomy.^[4]

However, the Kshara Sutra group had fewer days away from routine work, approximately 2.7 days compared with 15.5 days in the fistulotomy group.^[4]

The authors also reported lower treatment cost and less postoperative pain with Kshara Sutra, although wound discharge was more frequent.^[4]

This illustrates why surgical outcomes should not be evaluated using healing time alone. Important endpoints include.

healing, recurrence, pain, continence,

wound complications, return to work, cost and quality of life.

PATIENT SELECTION FOR KSHARA SUTRA

Kshara Sutra should not be considered appropriate for every fistula-in-ano. Important factors include.

location of internal opening, relation to sphincter complex, fistula anatomy,

intersphincteric/transsphincteric extension, branching,

recurrent disease, associated abscess, inflammatory bowel disease, tuberculosis,

malignancy and pre-existing continence status.

Complex or recurrent fistulae may require appropriate imaging and specialist assessment.

Therefore, the decision to use Kshara Sutra should be anatomy-based and patient-centered.

HYBRID APPROACHES IN FISTULA MANAGEMENT

A combined or hybrid approach may be considered in selected cases. For example.

Clinical and anatomical assessment



Control of sepsis



Identification of fistula anatomy



Definitive surgical or parasurgical strategy



Kshara Sutra / sphincter-preserving procedure / conventional surgery according to indication



Wound care and follow-up

The principle is not that one procedure is universally superior, but that the least harmful effective intervention should be selected according to anatomy and clinical circumstances.

ARSHA AND HEMORRHOIDAL DISEASE

Arsha is an important classical anorectal disorder. Its clinical correlation with hemorrhoidal disease is useful, but the two concepts should not be assumed to be completely identical.

Modern hemorrhoidal management depends on.

grade, bleeding, prolapse, pain, thrombosis,

response to conservative therapy and associated anorectal pathology.

Ayurvedic approaches described in the literature include conservative measures, Kshara application, Agnikarma and surgical procedures.

APAMARGA KSHARA IN HEMORRHOIDS

Shah and Dudhamal evaluated Apamarga Kshara application against sclerotherapy in 50 patients with first- and second-degree piles.^[5] The study reported improvement in bleeding and prolapse, with favorable results in the Apamarga Kshara group.^[5]

The study provides clinical evidence supporting further investigation of Kshara application, but its relatively small sample and open-label design limit the strength of the conclusion.

Larger randomized studies with standardized hemorrhoidal grading, validated symptom scores and long-term recurrence assessment are required.

PARIKARTIKA AND FISSURE-IN-ANO

Parikartika has been clinically correlated with fissure-in-ano, although the classical and modern concepts are not completely identical.

Dudhamal et al. conducted a comparative clinical study involving 100 patients with chronic fissure-in-ano, with 50 patients in each group.^[6]

Kshara Sutra suturing was compared with Kshara Sutra combined with Lord's anal dilatation.^[6]

The study reported earlier pain relief and healing in the group receiving combined

treatment.^[6]

A separate randomized clinical trial by Nakrani and Dudhamal included 30 patients, with 15 patients receiving Apamarga Kshara Sutra and 15 receiving open lateral internal sphincterotomy.^[7]

Both groups demonstrated significant clinical improvement. However, postoperative pain, bleeding, swelling and wound healing required longer in the Kshara Sutra group, and the authors concluded that open lateral internal sphincterotomy produced better results in their study.^[7] This is an important finding because a scientifically balanced review should report evidence that does not necessarily favor the Ayurvedic intervention.

WOUND MANAGEMENT: VRANA SHODHANA AND VRANA ROPANA

Wound management represents another potential interface between Shalya Tantra and pharmaceutical therapeutics.

Classical concepts include

Vrana Shodhana – cleansing and management of pathological wound conditions. Vrana Ropana – promotion of wound healing.

Contemporary wound healing is generally described through overlapping phases of: hemostasis, inflammation, proliferation and remodeling. These frameworks are not identical, but they may provide a useful basis for translational research.

A 2023 systematic review compiled clinical literature concerning Ayurvedic wound-healing formulations and procedures and emphasized the large but heterogeneous body of available research.^[10]

The review also highlighted the need for better-quality clinical research and systematic documentation.^[10]

POTENTIAL ROLE OF RASAUSHADHI IN SURGICAL PATIENTS

Rasaushadhi may have potential as an adjunct in selected clinical situations, but its use should be indication-dependent.

Potential areas for investigation include:

inflammatory modulation, analgesic effects, antimicrobial activity, wound healing, antioxidant activity and systemic supportive therapy.

However, experimental pharmacological activity cannot automatically be translated into clinical efficacy.

Similarly, classical indications cannot be treated as equivalent to modern clinical-trial

evidence.

Therefore, Rasaushadhi should not be routinely prescribed merely because a patient has undergone surgery.

PROCEDURE-DEPENDENT AND DRUG-DEPENDENT MANAGEMENT

A rational integrated model is: Diagnosis

↓
Disease severity + anatomy

↓
Definitive procedure

↓
Local wound management

↓
Assessment of systemic requirement

↓
Drug selection

↓
Dose and duration

↓
Safety monitoring

↓
Outcome assessment

For example, in fistula-in-ano: Anatomical assessment

↓
Fistulotomy / Kshara Sutra / sphincter-preserving / hybrid approach

↓
Local wound care

↓
Systemic therapy only when clinically indicated In perianal abscess:

Diagnosis

↓
Incision and drainage/source control

↓
Wound care

↓
Antibiotics when indicated

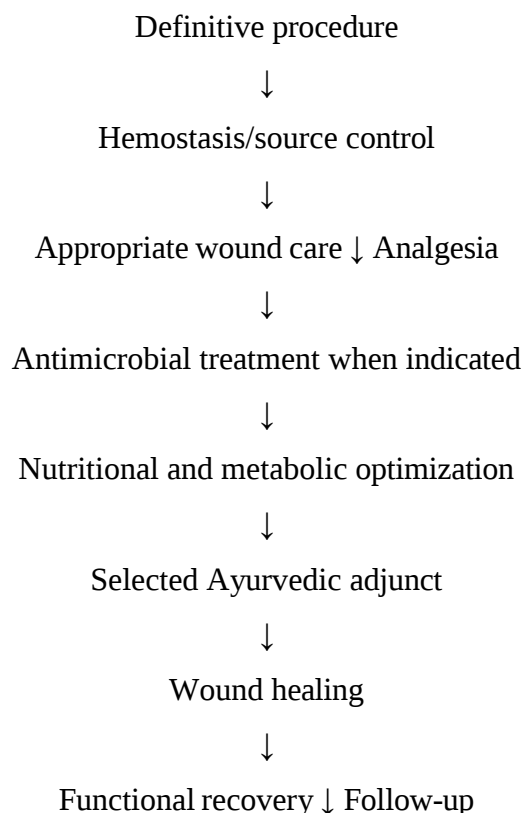
↓
Adjunctive treatment where appropriate

No Rasaushadhi should delay source control in abscess, necrotizing infection or another

surgical emergency.

POSTOPERATIVE MANAGEMENT

Postoperative treatment should be individualized according to: type of operation, wound condition, pain, infection risk, nutritional status, diabetes and other comorbidities, renal function, hepatic function, concurrent medications and safety profile of the proposed formulation. A practical framework is.



This prevents the misconception that a particular Rasaushadhi is mandatory after every surgical procedure.

PHARMACEUTICAL PROCESSING OF RASAUSHADHI

Classical Rasa-Shastra procedures can be studied using modern analytical methods.

Classical process Potential modern research domain Shodhana Physicochemical and impurity-profile changes Bhavana Surface and particle characteristics Marana Phase transformation Bhasma Pariksha Quality-control characterization Classical formulation Batch standardization Rasaushadhi Pharmacological and toxicological characterization

Srikanth et al. prepared three batches of Mahalaxmi Vilas Rasa according to classical standard operating procedures and evaluated them using physicochemical analysis, HPTLC, atomic absorption/ICP-AES and X-ray diffraction.^[9]

The investigation demonstrated the presence of several elemental and mineral phases and showed how modern analytical tools can contribute to standardization and quality assurance.^[9]

PHARMACEUTICAL STANDARDIZATION

A standardized Rasa-Shastra product should ideally involve: authenticated raw materials.

standardized pharmaceutical processing; controlled processing conditions;

batch-to-batch consistency; physicochemical characterization; elemental analysis; microbiological testing;

formulation-specific toxicological evaluation; stability assessment; and pharmacovigilance.

Duggal *et al.* analyzed 15 Ras-family Ayurvedic medicinal products from three manufacturers using X-ray fluorescence and X-ray diffraction techniques.^[8]

Mercury, lead and arsenic were detected in different products, with substantial variability between products and manufacturers.^[8] The authors recommended adequate quality-control mechanisms and production regulation.^[8]

This finding supports the need for formulation-specific quality assurance rather than assuming that all products carrying the same traditional name have identical pharmaceutical characteristics.

SAFETY OF RASA-SHAstra FORMULATIONS

Safety is a central consideration in the clinical use of Rasa-Shastra preparations.

The presence of a metal or mineral does not by itself establish toxicity. Risk depends upon chemical form, dose, bioavailability, exposure duration, manufacturing quality and patient-specific factors.

Nevertheless, safety cannot be assumed without appropriate testing.

Saper *et al.* examined 70 Ayurvedic herbal medicine products and detected lead, mercury and/or arsenic in 14 products (20%). The investigators reported that, according to manufacturer-recommended doses, these products could result in metal exposure above published regulatory standards.^[11]

A subsequent investigation of Ayurvedic medicines available through the Internet examined

230 products and evaluated the prevalence of lead, mercury and arsenic.^[12]

These studies should not be interpreted as evidence that all Ayurvedic products are unsafe. Instead, they demonstrate the importance of pharmaceutical quality control and product-specific testing.

TOXICOLOGICAL EVIDENCE

Nityanand Rasa is a herbo-metallic formulation containing ingredients associated with mercury and arsenic.

Kshirsagar et al. investigated subchronic oral toxicity in male and female Wistar rats over 90 days.^[13]

No mortality or severe behavioral changes were observed. However, biochemical changes occurred at medium and high doses, mild histopathological changes were observed at the high dose, and arsenic was detected in blood at the high dose.^[13]

The authors concluded that moderate toxic effects were observed at high doses and that the formulation appeared safer at therapeutic doses under the conditions of the study.^[13]

Animal toxicology cannot be directly extrapolated to therapeutic human dosing, but such studies demonstrate the importance of formulation-specific safety evaluation.

CLINICAL EVIDENCE SUMMARY

Table 1: Selected clinical evidence concerning Ayurvedic parasurgical interventions.

Intervention	Clinical condition	Study design/sample	Major finding
Kshara Sutra	Fistula-in-ano	Multicentric randomized trial; 502 patients	Complete healing reported in both treatment groups; healing was slower with Kshara Sutra.
Kshara Sutra	Fistula-in-ano	Prospective randomized comparison; 50 patients	Longer healing but fewer days away from routine work.
Apamarga Kshara	First/second-degree piles	Open-label randomized study; 50 patients	Favorable improvement in bleeding and prolapse reported.
Kshara Sutra suturing	Chronic fissure-in-ano	Comparative study; 100 patients	Combined Kshara Sutra + Lord's dilatation group showed earlier improvement.
Apamarga Kshara Sutra	Chronic fissure-in-ano	Randomized study; 30 patients	OLIS demonstrated faster postoperative recovery.
Ayurvedic wound therapies	Wound healing	Systematic review	Large but heterogeneous body of evidence.

PHARMACEUTICAL AND SAFETY EVIDENCE

Table 2: Selected pharmaceutical evidence.

Study	Subject	Major contribution
Srikanth et al.	Mahalaxmi Vilas Rasa	Demonstrated physicochemical, HPTLC, elemental and XRD characterization.
Duggal et al.	15 Ras-family products	Demonstrated variability in Hg, Pb and As among products/manufacturers.
Saper et al.	70 Ayurvedic products	Demonstrated detectable heavy metals in 20% of sampled products.
Saper et al.	230 Internet-available Ayurvedic medicines	Evaluated prevalence of Pb, Hg and As.
Kshirsagar et al.	Nityanand Rasa	Provided 90-day animal toxicology data.

DISEASE-WISE INTEGRATED APPROACH

Table 3: Proposed integrated clinical framework.

Condition	Classical correlation	Possible Ayurvedic intervention	Important contemporary consideration
Fistula-in-ano	Bhagandara	Kshara Sutra / selected parasurgical procedure	Sphincter anatomy and complexity determine treatment.
Grade I–II hemorrhoids	Arsha	Kshara application / conservative treatment	Grade and symptoms determine intervention.
Chronic fissure-in-ano	Parikartika	Selected Kshara Sutra-based procedure	Medical therapy and LIS remain important options.
Perianal abscess	Inflammatory anorectal disease	Adjunctive measures	Drainage/source control is fundamental.
Chronic wound	Dusta Vrana	Local wound management	Infection, ischemia, diabetes and malignancy require evaluation.
Complex fistula	Bhagandara	Individualized surgical/parasurgical strategy	Imaging and specialist assessment may be required.

DISCUSSION

The relationship between Rasa-Shastra and Shalya Tantra should be considered complementary rather than competitive.

Shalya Tantra provides the procedural framework for surgical and parasurgical management, while Rasa-Shastra provides a specialized pharmaceutical framework for processed metals, minerals and herbo-mineral preparations.

Kshara and Kshara Sutra represent an important interface between pharmaceutical preparation and Shalya Tantra.

Among the reviewed clinical evidence, Kshara Sutra for fistula-in-ano has the most substantial historical clinical evidence. The ICMR multicentric trial involving 502 patients reported complete healing in both Kshara Sutra and conventional-surgery groups, although healing was slower with Kshara Sutra.^[3]

The smaller randomized comparison by Dutta et al. similarly showed longer healing time

with Kshara Sutra but fewer days away from routine work and lower treatment cost.^[4]

These findings demonstrate that outcome assessment should incorporate multiple endpoints rather than focusing only on the duration of wound healing.

The evidence for Kshara application in hemorrhoids is promising but limited. The 50-patient randomized study of Apamarga Kshara provides supportive evidence but does not establish universal superiority over contemporary interventions.^[5]

The fissure literature provides an important example of balanced evidence. The 100-patient study demonstrated improvement with Kshara Sutra-based treatment, while the later 30-patient randomized trial found better postoperative recovery with open lateral internal sphincterotomy.^[6,7] Therefore, an evidence-based Ayurvedic surgical practice should not claim that Kshara Sutra or Kshara is universally superior to modern surgery.

A more scientifically defensible position is.

Ayurvedic parasurgical procedures may have clinically useful roles in appropriately selected patients, but treatment should be based on disease anatomy, evidence, expertise, patient factors and risk-benefit assessment.

The same principle applies to Rasaushadhi.

There is insufficient evidence to state that Rasaushadhi is routinely required after surgery. Its use should be based on a defined indication, standardized formulation, appropriate dose, duration and safety assessment.

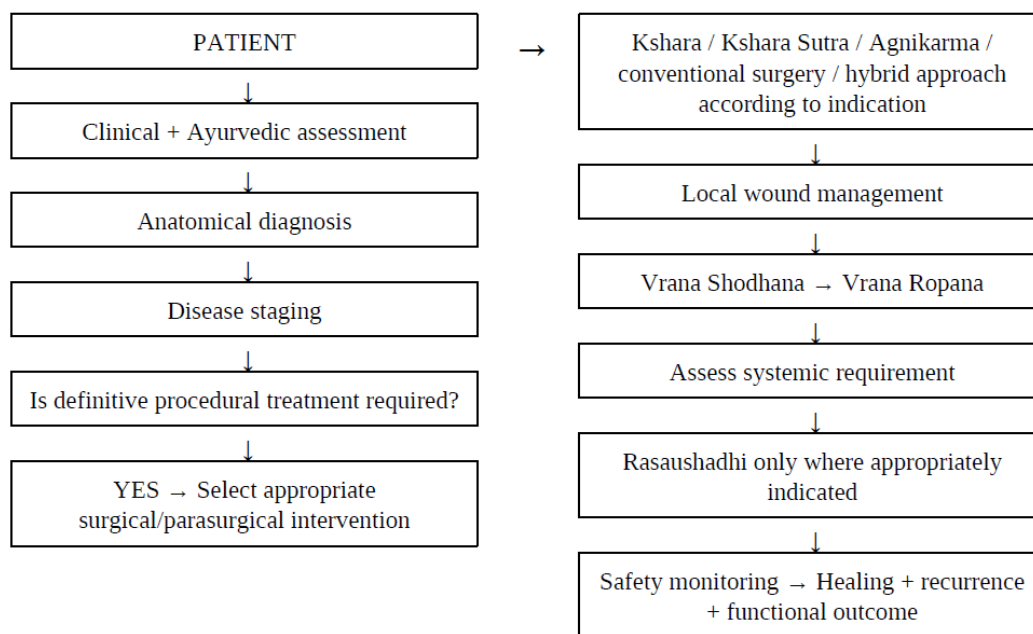
This is particularly important because analytical studies have demonstrated significant variation in the elemental composition of Ras-family products.^[8]

The studies of Saper et al. further demonstrate that quality control cannot be assumed merely from an Ayurvedic product label.^[11,12]

Thus, future Rasa-Shastra research should combine classical pharmaceutical knowledge with modern analytical science, toxicology, pharmacology and clinical research.

INTEGRATED CLINICAL DECISION-MAKING MODEL

A practical model can be proposed.



LIMITATIONS

The present review has several limitations.

First, clinical studies of Ayurvedic parasurgical procedures are heterogeneous. Second, several available studies have relatively small sample sizes.

Third, procedural trials are difficult to blind.

Fourth, Kshara Sutra preparation methods and treatment protocols may vary.

Fifth, clinical endpoints are not always standardized. Sixth, long-term contemporary comparative data remain limited.

Seventh, evidence concerning Rasaushadhi specifically in postoperative surgical patients is much less developed than evidence concerning Kshara Sutra.

Finally, evidence obtained from a particular standardized formulation cannot automatically be generalized to every commercially available product carrying the same traditional name.

FUTURE RESEARCH DIRECTIONS

Standardization of Kshara Sutra

Future studies should standardize:

thread material,
coating procedure,
number of coatings,
alkaline strength,

mechanical strength,
pharmaceutical stability, microbial quality and
replacement schedule.

Rasaushadhi research

Future investigations should incorporate:

raw-material authentication,

batch standardization,

XRF,

XRD,

ICP-MS/ICP-AES,

particle-size analysis,

bioaccessibility studies,

pharmacokinetics, toxicokinetics and

long-term safety assessment.

Clinical research

Future randomized trials should include.

adequate sample size,

predefined primary outcomes,

appropriate contemporary comparators,

standardized treatment protocols,

recurrence assessment,

continence assessment,

quality-of-life measurement,

adverse-event monitoring and adequate duration of follow-up.

Wound-healing research\

Objective outcome measures should include.

wound area,

percentage wound contraction,

epithelialization time,

granulation quality,

pain score,

infection rate,

microbiological parameters where indicated,
inflammatory markers and
histopathology when appropriate.

CONCLUSION

Rasa-Shastra and Shalya Tantra represent complementary but distinct domains of Ayurveda. Shalya Tantra provides the principles of surgical and parasurgical intervention, while Rasa-Shastra provides specialized pharmaceutical knowledge concerning processed metals, minerals and herbo-mineral preparations. Kshara and Kshara Sutra represent an important pharmaceutical–parasurgical interface. Clinical studies have demonstrated potential utility of Kshara Sutra in fistula-in-ano and have evaluated Kshara/Kshara Sutra interventions in hemorrhoids and fissure-in-ano. However, the available evidence does not justify an “Ayurveda versus modern surgery” approach. Instead, the appropriate treatment should be individualized according to anatomy, disease severity, evidence, patient factors, risk-benefit assessment and clinician expertise. Rasaushadhi should likewise not be regarded as universally necessary after surgical procedures. Its use should be indication-based and dependent upon pharmaceutical quality, appropriate dosing, duration and safety monitoring. 20 Modern analytical science provides an opportunity to strengthen Rasa-Shastra through reproducible pharmaceutical characterization, standardization and toxicological evaluation. Contemporary clinical-trial methodology can similarly strengthen Shalya Tantra by evaluating healing, recurrence, pain, continence, quality of life and cost-effectiveness. An evidence-informed integration of Rasa-Shastra, Shalya Tantra and contemporary surgical science may therefore provide a clinically meaningful framework for future research and practice.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS

Dr. Ankit T. Bansode contributed to the Rasa-Shastra, Bhaishajya Kalpana, pharmaceutical and safety sections and literature review.

Dr. Vaibhav H. Pagore contributed to the Shalya Tantra, parasurgical, anorectal and surgical sections and literature review.

Both authors contributed to manuscript preparation, critical interpretation and final approval of the manuscript.

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