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Ayurvedic Surgical Principles and Modern Minimally Invasive Surgery: A Comparative Review

Dr. Abhishek Suresh Shedage[1], Dr. Ramdhave Sarang Sureshrao[2], Dr. Omkar Subhash Jyotik[3]

[1] Assistant Professor, Department of Shalyatantra, S.C. Mutha Aryangla Vaidyak Mahavidyalaya, Satara, Maharashtra, India. Email: abhishekshedage@gmail.com

[2] Associate Professor, Department of Shalyatantra, Government Ayurved College, Dharashiv, Maharashtra, India. Email: drsarang100@gmail.com

[3] Assistant Professor, Department of Shalyatantra, Government Ayurveda College, Baramati, Maharashtra, India. Email: omkarjyotik29@gmail.com

Abstract

The development of minimally invasive surgery has changed operative care by reducing access-related injury while improving visualization, precision, and recovery. Long before these technological advances, Shalya Tantra had established an organized surgical discipline within Ayurveda, covering patient assessment, instruments, operative procedures, wound care, and postoperative management. This narrative review examines points of convergence and difference between classical Ayurvedic surgical thought and contemporary minimally invasive surgery. Relevant descriptions from the Sushruta Samhita, Charaka Samhita, Ashtanga Hridaya, and Madhava Nidana were considered alongside surgical literature identified through PubMed, Scopus, Web of Science, and Google Scholar. Both traditions value appropriate patient selection, accurate localization, controlled intervention, preservation of viable tissue, and careful aftercare. Procedures such as Kshara Karma, Agni Karma, Kshara Sutra, and Jalaukavacharana also illustrate how a therapeutic objective may sometimes be achieved through a localized intervention rather than extensive tissue disruption. These similarities are chiefly philosophical and procedural; they do not make classical methods equivalent to laparoscopy, endoscopy, robotics, or image-guided surgery. Modern minimally invasive surgery depends on imaging, anesthesia, sterile systems, specialized devices, and standardized training, whereas Ayurvedic procedures arise from a different diagnostic and therapeutic framework. Selected parasurgical and wound-care practices may have complementary clinical value, but their indications, safety, and comparative effectiveness require stronger evidence.

Keywords

Shalya Tantra; minimally invasive surgery; Ayurveda; Kshara Karma; Agni Karma; wound healing; parasurgical procedures

1. Introduction

Surgery is undertaken to correct structural disease, remove or repair pathological tissue, control bleeding

or infection, and restore function. During the past several decades, many operations that once required wide exposure have moved toward smaller-access techniques. Laparoscopic, endoscopic, robotic, and image-guided procedures can reduce incision size, postoperative pain, and hospital stay in appropriately selected patients, although their benefits vary by procedure and clinical context [1].

Ayurveda also preserves a substantial surgical tradition under Shalya Tantra. The Sushruta Samhita describes Yantra and Shastra, operative maneuvers, suturing, management of wounds, extraction of foreign bodies, and postoperative care [2]. It repeatedly emphasizes examination before intervention, deliberate handling of tissue, removal of the offending factor, protection of healthy structures, and prevention of complications. These concerns remain recognizable to a modern surgeon, even though the scientific knowledge, instruments, and operative environment are very different.

A comparison is therefore useful when it identifies shared clinical principles without claiming historical identity between unlike procedures. The present review considers how classical reasoning about precision, limited injury, wound care, and individualized treatment relates to the aims of modern minimally invasive surgery.

Aim and Objectives

The aim is to critically compare major principles of Shalya Tantra with contemporary minimally invasive surgery. The review examines classical surgical concepts, outlines the defining features of minimally invasive approaches, identifies defensible areas of similarity and difference, and considers where evidence-based integration may be possible.

2. Methodology of Literature Review

A narrative review was undertaken using the Sushruta Samhita, Charaka Samhita, Ashtanga Hridaya, and Madhava Nidana as classical sources. Contemporary literature was searched in PubMed, Scopus, Web of Science, and Google Scholar with combinations of “Ayurvedic surgery,” “Shalya Tantra,” “minimally invasive surgery,” “Kshara Karma,” and “Agni Karma.” Classical descriptions of surgical procedures, clinically relevant studies of minimally invasive surgery, and comparative or applied research on parasurgical techniques were included. Non-surgical material, unauthenticated sources, and reports without clear clinical relevance were excluded. Because the review is narrative, it offers a conceptual synthesis rather than a systematic estimate of efficacy.

3. Historical Background of Ayurvedic Surgery

The word Shalya commonly refers to a foreign or harmful factor that causes pain or dysfunction and may require removal. Classical Shalya Tantra, however, extends beyond extraction. It includes incision, excision, scraping, probing, drainage, suturing, and the management of trauma and wounds [3]. Sushruta also gave unusual importance to practical instruction. Students were expected to understand instruments and operative steps and to develop manual skill through repeated practice before treating patients. This attention to training, dexterity, and procedural judgment is one of the most enduring features of the tradition.

4. Principles of Shalya Tantra

Roga Pariksha precedes any operative decision. The physician evaluates the nature and location of disease, the patient's strength, the condition of the involved tissue, and the appropriate time for intervention. In contemporary terms, these concerns resemble diagnosis, preoperative risk assessment, assessment of operability, and patient selection, although the parameters used are not identical.

Yukti Vyapashraya Chikitsa places rational planning at the center of treatment. The procedure should fit the disease, the patient, and the local tissue condition rather than being chosen mechanically. Modern evidence-based surgery follows a comparable decision principle by integrating available evidence, anatomy, disease severity, operator expertise, and patient preference.

Classical instruments were designed around specific actions. Mandalagra, Karapatra, Vriddhipatra, and Nadi Yantra, for example, served cutting, scraping, extraction, drainage, or exploration functions [4]. Their construction differs fundamentally from modern devices, but the underlying principle remains familiar: instrument geometry should match the intended tissue action while limiting avoidable injury.

5. Modern Minimally Invasive Surgery

Minimally invasive surgery seeks to accomplish a diagnostic or therapeutic goal through the least disruptive access that remains safe and effective. Laparoscopy uses ports, a camera, insufflation, and long instruments to operate within body cavities. Endoscopy reaches gastrointestinal, respiratory, urinary, and other luminal structures through natural orifices or small access routes. Robotic platforms add three-dimensional visualization, tremor filtering, articulated instruments, and ergonomic control. Image-guided interventions use ultrasonography, fluoroscopy, computed tomography, or magnetic resonance imaging to direct needles, catheters, and ablative devices.

Smaller access does not automatically mean a minor procedure. These techniques require anesthesia planning, sterile practice, equipment, trained teams, and readiness to manage bleeding, organ injury, conversion to open surgery, or other complications. The appropriate comparison is therefore not simply incision size, but the balance between therapeutic benefit, access trauma, technical risk, and patient recovery.

6. Comparative Analysis

At a broad level, Shalya Tantra and minimally invasive surgery share an interest in accurate assessment, purposeful intervention, protection of unaffected tissue, and recovery after the procedure. Classical Shastra Karma corresponds generally to operative action, Yantra to purpose-built instrumentation, and Vrana Chikitsa to wound care. Kshara and Agni procedures may be compared with chemical or thermal tissue destruction because they use controlled local action. Such comparisons describe functional resemblance only; they should not be read as claims that the procedures have identical mechanisms, indications, precision, or evidence.

Ayurvedic principle or procedure	Contemporary point of comparison
Roga Pariksha and patient-strength assessment	Preoperative assessment and patient selection
Yantra and Shastra chosen for a defined action	Procedure-specific instruments and devices
Protection of healthy structures	Tissue-preserving access and dissection
Kshara Karma	Localized chemical cauterization or ablation
Agni Karma	Localized thermal intervention
Vrana Shodhana and Ropana	Wound-bed preparation and support of repair

7. Ayurvedic Parasurgical Procedures and Modern Correlation

Kshara Karma uses an alkaline preparation to produce a controlled local effect. It has been described for selected conditions such as hemorrhoids, fistulous disease, and certain superficial lesions. Its chemical action invites comparison with cauterizing or ablative procedures, but concentration, depth of injury, application technique, and tissue response must be standardized before outcomes can be compared reliably.

Agni Karma applies therapeutic heat at a defined site. Classical indications include selected painful conditions and localized lesions. Modern thermal ablation also destroys or modifies tissue with heat, yet it uses measurable energy delivery, imaging or direct visualization, and device-specific safety controls. The similarity lies in localized thermal intervention, not in technological equivalence.

Raktamokshana includes methods such as Siravyadha and Jalaukavacharana. Medicinal leeches have a recognized contemporary role in relieving venous congestion, especially when used by trained teams in reconstructive care. Their use requires attention to bleeding, infection, anemia, and antibiotic protocols. Broader claims for inflammatory disorders need indication-specific evidence.

8. Wound Management: Ayurvedic and Modern Perspectives

Vrana is understood as disruption of normal tissue structure and function. Classical management includes Shodhana to cleanse an unhealthy wound, Ropana to support repair, protection from contamination, appropriate local applications, and dietary and behavioral care [5]. These stages reflect close observation of the wound rather than reliance on a single universal dressing.

Modern wound healing is usually described through overlapping inflammatory, proliferative, and remodeling phases. Treatment addresses perfusion, bacterial burden, devitalized tissue, moisture balance, pressure, systemic disease, and nutrition. Debridement, irrigation, sterile or clean dressings as appropriate, infection control, and advanced wound products are selected according to wound type. Vrana Shodhana can be compared functionally with cleansing and debridement, Ropana with support of tissue repair, and Raksha Karma with protection from infection, but each term retains its own clinical context.

9. Ayurvedic Drugs in Surgical Wound Care

Honey is one of the best studied traditional wound applications. Medical-grade honey can provide an osmotic and antimicrobial environment and may assist autolytic debridement and granulation in selected wounds [6]. Evidence for a prepared medical product should not be transferred automatically to household honey, which may be contaminated and is not appropriate for routine surgical use.

Haridra (Curcuma longa) and Neem (Azadirachta indica) have demonstrated anti-inflammatory or antimicrobial activity in experimental and preliminary clinical work. Jatyadi Taila is widely used in Ayurvedic wound care. However, formulation quality, sterility where required, wound category, dressing frequency, and adverse events need clearer reporting. Topical agents should be used only after assessment for ischemia, deep infection, foreign material, necrosis, or a need for surgical debridement.

10. Contemporary Minimally Invasive Techniques

Common laparoscopic procedures include cholecystectomy, appendectomy, and selected hernia repairs. Compared with open approaches, patients may experience less access-related pain, shorter hospitalization, and improved cosmetic outcomes, although results depend on the procedure, surgeon, and patient [7]. Therapeutic endoscopy can remove polyps, control bleeding, retrieve foreign bodies, dilate strictures, and provide drainage without conventional operative access. Robotic surgery may improve visualization and instrument articulation in confined spaces, but cost, operating time, access to equipment, and the need for specialized training remain important limitations.

11. Conceptual Similarities

Three similarities deserve emphasis. First, both approaches require the intervention to be selected for the patient and lesion rather than by diagnosis alone. Second, both value controlled tissue handling and preservation of healthy structures. Third, recovery is treated as part of surgery itself: wound care, diet, pain, mobility, and surveillance for complications influence the final outcome. These shared principles offer a reasonable basis for dialogue even when the procedures themselves are dissimilar.

12. Important Differences

Shalya Tantra is grounded in Ayurvedic assessment of Dosha, Dhatu, local tissue state, strength, and disease stage. Modern surgery is organized around anatomy, pathology, imaging, physiology, microbiology, and evidence-based perioperative protocols. Contemporary MIS has a far wider range of internal operative capability and relies on anesthesia, optics, energy devices, sterile processing, and multidisciplinary teams. Classical parasurgical methods generally produce local chemical, thermal, mechanical, or biological effects without the visualization and instrument control available in modern MIS. These differences limit direct comparison and make modern safety standards essential whenever traditional procedures are used clinically.

13. Current Evidence and Clinical Applications

Kshara Sutra is among the most investigated Ayurvedic procedures. In selected fistula-in-ano cases, the medicated thread produces gradual division of the tract with concurrent drainage and healing [8]. Outcomes are influenced by fistula anatomy, operator skill, preparation standards, treatment duration, and follow-up; complex fistulas still require detailed imaging and specialist assessment. Jalaukavacharana has clearer contemporary acceptance for venous congestion in compromised flaps and replanted tissues [9]. Beyond these indications, evidence remains heterogeneous and should be interpreted condition by condition.

14. Research Gaps and Limitations

Much of the available Ayurvedic surgical literature consists of single-center studies, case series, or protocols that vary in preparation and application. Randomized comparative trials are limited, and outcomes such as pain, healing time, recurrence, continence, infection, quality of life, and cost are not reported consistently. Future multicenter studies should define eligibility and technique in advance, use standard outcome sets, document adverse events, and include adequate long-term follow-up. Product characterization and operator training are as important as the name of the procedure.

15. Future Perspectives

The most realistic opportunities for integration lie in rigorously evaluated parasurgical procedures, standardized wound-care products, perioperative rehabilitation, and supportive pain management. Ayurvedic plants may also contribute to biomaterials or antimicrobial dressings, but development must include pharmacological characterization, biocompatibility, sterility, and clinical testing. Integration should add a demonstrable benefit to safe surgical care rather than replace an indicated operation or delay referral.

16. Conclusion

Shalya Tantra is an early organized surgical tradition with detailed attention to diagnosis, instruments, operative action, wounds, and postoperative care. Modern minimally invasive surgery pursues several comparable clinical goals—precision, limited access injury, tissue preservation, and faster functional recovery—through technologies unavailable to classical practice. Kshara Karma, Agni Karma, Kshara Sutra, Jalaukavacharana, and *Vrana Chikitsa* may have value in selected settings, but functional resemblance should not be confused with equivalence to laparoscopy, endoscopy, robotics, or image-guided treatment. Their contemporary role should be determined through standardized practice, transparent safety reporting, and high-quality comparative research.

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