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REVIEW ARTICLE

Surgical Technique and Histopathology

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ABSTRACT

Background: Surgical technique and histopathology are closely connected components of patient care. A carefully performed operation removes or repairs diseased tissue, while histopathological examination establishes its microscopic nature. Classical Ayurveda, particularly Shalya Tantra (surgical discipline), describes preoperative assessment, operative procedures, haemostasis, wound management and postoperative care. Although microscopic histopathology was not available in the classical period, careful observation of excised tissues, swellings, ulcers and wounds formed an important part of surgical decision-making.

Aim: To review surgical techniques and histopathological examination from modern and Ayurvedic perspectives.

Objectives: To study the fundamental principles of Shalya Tantra. To describe the essential steps of modern surgical procedures. To explain surgical specimen handling and histopathological examination. To understand the relationship between surgical technique and accurate tissue diagnosis.

Materials and Methods: A narrative review was conducted using classical Ayurvedic texts, modern surgical textbooks, pathology textbooks and recognised surgical safety and specimen-handling guidelines. Information concerning operative principles, tissue handling, fixation, processing, staining, microscopic examination and reporting was collected and critically analysed.

Results & Discussion: Surgery and histopathology function as a continuous diagnostic and therapeutic process. The surgeon determines specimen quality, while the pathologist provides information concerning diagnosis, grade, margins and prognosis.

Conclusion: Meticulous surgical technique and standardised histopathological examination improve diagnostic accuracy, treatment planning and patient outcomes. Classical Shalya Tantra provides a valuable historical and conceptual foundation for understanding systematic surgical care.

Keywords: *Shalya Tantra, surgical technique, histopathology, surgical specimen, tissue diagnosis, wound management*

INTRODUCTION

Surgical technique refers to the organised methods used to diagnose, treat or control disease through operative intervention. It includes patient selection, preoperative planning, anaesthesia, positioning, incision, dissection, haemostasis, completion of the intended procedure, wound closure and postoperative care. Histopathology is the examination of diseased tissue at gross and microscopic levels. It confirms the nature of a lesion and may determine its

type, grade, extent, margin status and biological behaviour. Therefore, surgery and histopathology should not be viewed as separate activities. They represent two connected stages of one clinical process.

A successful operation does not end with the removal of diseased tissue. The specimen must retain its identity, orientation and structural integrity until it reaches the pathology laboratory. Crushing, cautery, fragmentation, delayed fixation, incorrect labelling or inadequate clinical information may interfere with microscopic interpretation. Similarly, a detailed pathology report may influence the need for repeat excision, wider surgery, lymph-node evaluation, chemotherapy, radiotherapy or clinical surveillance. The relationship between surgeon and pathologist is therefore essential for accurate diagnosis and complete patient management.

In Ayurveda, surgery developed principally under Shalya Tantra. Acharya Sushruta explained surgical instruments, operative procedures, wound examination, haemostasis, bandaging and postoperative management in a remarkably systematic form. Classical descriptions were based mainly on direct observation, touch, probing and macroscopic features rather than microscopic cellular examination. Consequently, classical examination of tissues should not be presented as modern histopathology. However, the careful assessment of colour, consistency, discharge, depth, margins and healing characteristics demonstrates an early clinicopathological approach to disease.

AIM AND OBJECTIVES

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MATERIALS AND METHODS

This narrative review was prepared through a conceptual study of the Sushruta Samhita, Charaka Samhita, standard textbooks of surgery and pathology, and recognised guidelines related to safe surgery and surgical specimen handling. Relevant material was arranged under preoperative, operative, postoperative and histopathological headings. Classical observations were interpreted in their original context and then compared cautiously with modern principles. No direct equivalence was assumed between ancient macroscopic tissue examination and contemporary microscopic histopathology.

AYURVEDIC REVIEW

Concept of Shalya Tantra

Shalya Tantra is the branch of Ayurveda concerned with the identification and removal of foreign bodies and other harmful substances producing pain, swelling, obstruction or tissue injury. The term Shalya broadly refers to a foreign or disturbing factor present within the body, while Tantra signifies a systematic body of knowledge. Its scope includes trauma, wounds, abscesses, fractures, dislocations, anorectal disorders, urinary calculi and different surgical conditions. The approach is not confined to the physical act of operation. It includes diagnosis, assessment of strength, preparation of the patient, selection of instruments, operative intervention and wound rehabilitation.

Trividha Karma: The Three Stages of Surgery

Acharya Sushruta organised surgical management into Purva Karma (preoperative measures), Pradhana Karma (principal operative procedure) and Paschat Karma (postoperative measures). Purva Karma includes examination of the patient and disease, assessment of fitness, preparation of instruments and arrangement of the operative environment. Pradhana Karma consists of performing the indicated procedure with suitable instruments and careful technique. Paschat Karma includes haemostasis, cleaning, dressing, dietary regulation, wound observation and prevention of complications. This three-stage arrangement remains conceptually useful because modern surgery is similarly divided into preoperative, intraoperative and postoperative phases.

Ashtavidha Shastra Karma

The eight principal operative procedures described in Sushruta Samhita are Chedana (excision), Bhedana (incision), Lekhana (scraping), Vedhana (puncturing), Eshana (probing), Aharana (extraction), Visravana (drainage) and Sivana (suturing). Chedana may be conceptually related to removal of an abnormal growth or diseased structure. Bhedana provides access to a cavity or swelling. Lekhana removes unhealthy surface tissue. Vedhana permits puncture or aspiration. Eshana examines the direction and depth of a tract. Aharana removes foreign material, while Visravana facilitates evacuation of pathological fluid. Sivana brings divided tissues together. These procedures show that surgical intervention was selected according to the nature, location and stage of disease.

Surgical Instruments and Operative Precision

Classical surgical instruments were broadly classified as Yantra (blunt instruments or mechanical devices) and Shastra (sharp instruments). Their selection depended upon the intended operation, anatomical site and character of the lesion. The instruments were expected to be properly designed, sharp, clean and suitable for controlled use. Training was advised on fruits, vegetables, leather, animal tissues and artificial models before operating on patients. This emphasis on simulation, manual practice and familiarity with instruments reflects the recognition that surgical competence requires repeated training rather than theoretical knowledge alone.

Examination of the Patient and Surgical Lesion

The patient was evaluated through Darshana (inspection), Sparshana (palpation) and Prashna (questioning). The lesion was assessed for colour, size, shape, temperature, tenderness, consistency, depth, discharge and relation to surrounding structures. In swellings and ulcers, differences in colour, pain, induration, suppuration, margin and tissue condition helped determine the stage and treatment. This was essentially a clinicomacroscopic method. It cannot reveal cellular atypia, mitotic activity, receptor expression or molecular alteration, but it demonstrates the importance given to systematic observation before surgical intervention.

Vrana and Assessment of Tissue Condition

The concept of Vrana includes traumatic wounds, surgical wounds and ulcers. A healthy healing wound was expected to show clean tissue, proper approximation, controlled discharge and gradual restoration of normal colour and function. Features such as excessive pain, foul smell, abnormal discharge, discoloration, swelling, necrotic appearance or delayed healing indicated a disturbed wound. Shuddha Vrana denotes a clean wound suitable for healing, whereas Dushta Vrana denotes a contaminated, chronic or unhealthy wound. These descriptions are based on clinical appearance and should be correlated cautiously with modern infection, inflammation, necrosis and impaired healing.

Principles of Incision and Tissue Handling

Classical surgical instructions emphasise decisiveness, steadiness and knowledge of anatomical structures. An incision must be sufficient to expose the lesion but should avoid unnecessary injury. Modern tissue handling similarly favours precise dissection along anatomical planes, preservation of vital structures and minimal crushing, traction or thermal damage. Gentle technique supports healing and also improves the quality of tissue submitted for examination. Excessive force may distort cells, while extensive electrocautery may produce thermal artefacts at the resection margin and make histological assessment difficult.

Haemostasis in Ayurveda

Four broad approaches to haemostasis are described: Sandhana (approximation or closure), Skandana (promotion of coagulation), Pachana (measures facilitating local control) and Dahana (cauterisation). Pressure, cold application, medicinal substances, ligation-like measures and thermal cautery were used according to the clinical situation. Modern surgery achieves haemostasis through pressure, sutures, vessel ligation, clips, electrocautery, ultrasonic devices, topical agents and blood-component support. Effective haemostasis protects the patient from blood loss and improves visibility of the operative field, but uncontrolled cautery near a diagnostic margin may impair tissue interpretation.

Kshara Karma and Agni Karma

Kshara Karma involves the controlled application of an alkaline substance to perform cutting, scraping, draining or cauterising actions. Agni Karma uses therapeutic heat for selected lesions and haemostasis. Both require precise indication, protection of surrounding tissue and careful aftercare. Their effects are not identical to modern chemical ablation, electrosurgery or thermal coagulation, although limited functional similarities may be recognised. From a histopathological viewpoint, chemically or thermally treated tissue may show coagulation, necrosis and architectural

distortion. Therefore, the pathologist should be informed when such treatment has been applied before tissue sampling.

Sivana Karma and Wound Closure

Sivana Karma refers to suturing and approximation of divided tissue. Classical instructions indicate that contaminated material should be removed and bleeding controlled before closure. The method of suturing was selected according to the location and nature of the wound. Modern closure follows comparable general objectives: elimination of dead space, accurate approximation without excessive tension, preservation of circulation and selection of an appropriate suture or staple. A specimen requiring margin assessment should be oriented before closure, because the operative site may become difficult to reconstruct after tissue removal.

Prevention of Infection

Cleanliness of the operative area, instruments, wound and attendants received importance in classical surgical care. Measures described in the original historical context cannot be considered equivalent to current sterilisation, microbiology or antimicrobial protocols. Modern prevention includes hand hygiene, sterilised instruments, skin preparation, sterile barriers, antibiotic prophylaxis when indicated and continuous surveillance for surgical-site infection. The World Health Organization Surgical Safety Checklist further promotes confirmation of patient identity, procedure, operative site, antibiotic administration, instrument counts and specimen labelling.

Postoperative Care and Wound Observation

Paschat Karma includes monitoring, dressing, dietary management, pain control, protection of the wound and recognition of complications. The appearance of the wound, discharge, smell, swelling, tenderness and systemic condition of the patient guide further care. Modern postoperative monitoring also evaluates haemodynamic stability, pain, bleeding, infection, wound dehiscence, organ function and nutritional status. Histopathological findings become part of postoperative planning because an unexpected diagnosis, involved margin or aggressive tumour grade may alter the original treatment plan.

MODERN SURGICAL TECHNIQUE

Modern surgical practice begins with verification of diagnosis and assessment of operative risk. Clinical examination, laboratory tests, imaging, anaesthetic evaluation, optimisation of associated disease and informed consent are completed before surgery. The intended procedure, expected benefits, possible alternatives, complications and requirement for tissue examination should be explained. Inside the operating room, correct patient identity, operative site, consent, equipment, anticipated blood loss and specimen requirements are verified through a structured safety process.

The principal operative stages are anaesthesia, positioning, skin preparation, draping, incision, exposure, dissection, definitive treatment, haemostasis, irrigation when required, closure and dressing. Surgical methods include open surgery, laparoscopic surgery, endoscopic surgery, robotic-assisted procedures and microsurgery. Regardless of approach, the basic principles are adequate exposure, accurate identification of structures, gentle tissue handling, control of bleeding, preservation of viable tissue and prevention of contamination.

HISTOPATHOLOGICAL EXAMINATION

Histopathology begins when tissue is obtained by biopsy, excision or surgical resection. The container and request form must carry matching patient identifiers, specimen site, type of procedure and relevant clinical information. For complex oncological resections, the surgeon may orient the specimen using sutures, clips, diagrams or labelled containers. Separate samples should be placed in separately identified containers. Proper orientation allows the pathologist to identify anatomical margins and determine whether the lesion has been completely removed.

Most routine tissues are preserved in 10% neutral buffered formalin. Fixation should begin promptly because delay permits autolysis and deterioration of cellular details. After fixation, the specimen is described and dissected during gross examination. Representative areas, including lesion, margins, adjacent tissue and lymph nodes when indicated, are selected. The tissue is dehydrated, cleared, embedded in paraffin, cut into sections of approximately 3–5 µm and routinely stained with haematoxylin and eosin. Special stains, immunohistochemistry, molecular tests or frozen-section examination may be added according to the diagnostic requirement.

The final report may contain specimen description, histological diagnosis, tumour type, grade, size, depth of invasion, lymphovascular invasion, perineural invasion, lymph-node status and surgical margins. Histopathology confirms many benign, inflammatory, infective and malignant conditions. It also identifies unexpected lesions that were not evident clinically. In cancer surgery, an involved margin may indicate residual disease and may lead to re-excision or additional therapy. Thus, the report is not merely a laboratory result. It is a major clinical document guiding treatment and prognosis.

SAMPRAPTI AND CLINICOPATHOLOGICAL PROGRESSION

The following flow chart presents a conceptual progression of a surgically manageable lesion. It is not intended as the Samprapti of every surgical disease:



Figure 1. Conceptual progression from causative factors to definitive management.

In modern terms, genetic, environmental, traumatic, infective or inflammatory factors may initiate cellular injury. Continued injury can lead to inflammation, repair, fibrosis, necrosis, dysplasia or neoplasia. The clinical lesion is evaluated and representative tissue is obtained. Histopathology then characterises the cellular and architectural changes and assists in determining the final diagnosis.

RESULTS AND FINDINGS

- Shalya Tantra presents surgery as a complete process involving preparation, operative intervention and postoperative care.
- Ashtavidha Shastra Karma demonstrates procedure-based selection according to the character of the lesion.
- Classical examination relied on clinical and macroscopic features and was not equivalent to microscopic histopathology.
- Gentle tissue handling, anatomical precision and proper haemostasis are important in both traditional and modern surgical reasoning.
- Modern surgical safety requires confirmation of patient identity, procedure, site, consent, antibiotic prophylaxis, counts and specimen labelling.
- Histopathological quality begins in the operating room rather than only in the pathology laboratory.
- Crushing, fragmentation, thermal injury and delayed fixation may create artefacts and reduce diagnostic accuracy.

- Proper specimen orientation is especially important in the assessment of surgical margins.
- Histopathology confirms diagnosis and supplies information regarding tumour grade, extent, lymph-node involvement and prognosis.
- Communication among the surgeon, nursing team and pathologist reduces preventable errors.

DISCUSSION

Classical Shalya Tantra reveals a structured surgical tradition based on observation, practical training, selection of instruments and stage-wise patient management. Its value lies in the systematic organisation of surgical care and not in retrospective claims that ancient methods were identical to modern surgery. Terms such as Chedana, Bhedana, Visravana and Sivana describe recognisable operative actions, but contemporary procedures are supported by anaesthesia, imaging, sterilisation, physiological monitoring and evidence-based safety standards. A balanced interpretation preserves the originality of Ayurvedic knowledge while recognising the technical development of present-day surgery.

Histopathology extends clinical vision beyond the visible surface of a lesion. A mass that appears well circumscribed may show microscopic infiltration, while a clinically suspicious lesion may prove benign. However, the reliability of this diagnosis depends on pre-analytical quality. Incorrect site identification, incomplete clinical information, inadequate fixation and poor orientation can compromise even technically excellent laboratory processing. For this reason, the surgeon has a direct role in pathological quality assurance. The pathologist, in turn, should communicate immediately when the specimen is inadequate or when the findings require clarification of orientation or operative anatomy.

The integration of surgical technique and histopathology is most evident in cancer care. The operation provides tissue for definitive classification, and the pathological findings determine whether the surgical objective has been achieved. Margin status, depth of invasion, tumour grade, lymphovascular invasion and nodal spread may modify further management. The same principle applies to inflammatory, infective and degenerative lesions where tissue examination resolves diagnostic uncertainty. Therefore, safe surgery, proper specimen management and accurate pathological reporting should be treated as one continuous quality pathway centred on the patient.

CONCLUSION

Surgical technique and histopathology are complementary disciplines that jointly support diagnosis, treatment and prognosis. Classical Shalya Tantra provides important principles of patient examination, operative planning, instrument selection, incision, haemostasis, tissue removal, suturing and postoperative wound care. Modern histopathology adds microscopic, immunohistochemical and molecular assessment to the clinical and macroscopic examination of disease.

The best outcomes are achieved when the surgeon removes and handles tissue carefully, the operative team labels and transports it correctly, and the pathologist examines and reports it systematically. Their coordinated practice strengthens diagnostic accuracy, reduces errors and helps provide complete patient-centred care.

DECLARATIONS

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