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Āryavaidyan

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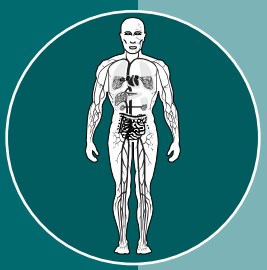

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Aryavaidyan is intended to encourage scientific writing and intellectual interactions among scholars, academicians, practitioners and students of ayurveda and allied subjects like Siddha, Unani, modern medicine, etc.

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PHARMACOGNOSTIC STUDIES ON *TRAGIA PLUKENETII*

Sama Venkatesh, T. Rajini, P. Balaraju, P. Ravi Kumar and K. Usha*

Abstract: Pharmacognostical studies of crude drugs facilitate the researchers for appropriate identification of a drug and abolish adulteration and provide a basis for authentication of crude drug. The aerial parts of *Tragia plukenetii* R. Smith (Euphorbiaceae) have scientifically proved as antitumour, antidiabetic and to be useful in treatment of pains and traditionally claims to be useful in treatment of various disorders. In view of its medicinal importance and taxonomic confusion within the genus of *Tragia*, a detailed pharmacognostical studies were carried out on *T. plukenetii*.

Introduction

With the vast history of knowledge and general safety profile available, India leads in using over 1500 raw herbs, out of which about 100-150 raw herbs are extensively used and in appreciable tonnages, either in traditional medicine usage or as health supplements, or in cosmetic preparations and also as extract for export.[1]

Standardization of natural products is a complex task due to their heterogenous composition, which is in the form of old plants, plant parts or extract obtained thereof. To ensure reproducible quality of herbal products, proper control of starting material is essential. The first step of ensuring quality of starting material is authentication. In recent years there has been a rapid increase in standardization of selected medicinal plants of potential therapeutic significance.[2-3] Despite the modern techniques, identification of plant drugs by pharmacognostical studies is more reliable. Absence of availability of specification for assessment of minimum quality of raw herbs has been a deterrent for improved usage of them and acceptability of scientific community and public. According to World Health Organization, the macroscopic and microscopic description of medicinal plants are first steps of establishing the identity and degree of purity of herbal drugs and should be carried out before any tests.

Tragia plukenetii R. Smith (Euphorbiaceae) is locally known as chinnadulagondi. *Tragia plukenetii* is an herb or undershrub, grows to 1m height, with sparsely hispid stinging hairs. This plant is widely distributed over India in waste lands, forests and banks of paddy fields. Aqueous decoction of aerial parts of *Tragia plukenetii* is claimed to be useful in the

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treatment of diabetes and pain. The ethanolic extract of the plant is reported to possesses antitumor and antioxidant activity at a dose of 100, 200 and 300 mg/kg[4] and has proved to be useful as antinociceptive agent.[5] Perusals of reports reveal that there is no unanimity with regard to its correct identity and taxonomic position. *T. plukenetii* is regarded as a variety or it is an unambiguous synonym of *Tragia cannabis*, *Tragia involucrata* and *Tragia tripatia*.[6,7] However, some taxonomists consider *Tragia plukenetii* as a distinct species.[8-10] *Tragia involucrata* has long been valued for its use in hemorrhagic disease, anorexia and constipation properties and is official in Indian pharmacopeia.[11a] Hence, a study is desirable on pharmacognostical characters of this plant to supplement useful data in regard to its correct identity and also on taxonomic confusion with reference to *Tragia involucrata* and *T. cannabis*.

Materials and methods

Fresh plant specimens of *Tragia plukenetii* were collected from Vallur mandal of Kadapa district, Andhra Pradesh, India and identified/ authenticated by taxonomist, P.G. College of Science, Hyderabad [Voucher specimen (TRP-303-09) deposited in the Department of Pharmacognosy, G. Pulla Reddy College of Pharmacy, Hyderabad]. Standard microscopic technique were followed to examine.[12,13] Fresh plant materials are used for the study of macroscopic and microscopic characteristics, whereas dried material is used for the determination of ash values, extractive values and phytochemical constituents. All the reagents used were of analytical grade obtained from SD Fine chemicals limited, Mumbai, India.

Results and discussion

Morphology

Tragia plukenetii is an herb/under-shrub having sparsely hispid stinging hairs. Roots occur in pieces of 2-8 cm long and 0.2-1 cm diameter; woody, cylindrical, light brown; no characteristic odour and taste. Stem is cylindrical, slender, hairy, stinging to touch, moderately hard, fibrous; 0.2-0.7 cm diameter; light gray colour; no characteristic odour and taste. Leaf is simple, petiolate, stipulate, stinging to touch, palmately 3 lobed with stinging hairs, middle lobe longer than the lateral, dentate, green in colour; 3-10 cm long and 0.5-2 cm width; no characteristic odour and taste. (Fig. I)

Histology

The thin transverse section of leaf, stem and root were treated with appropriate reagents and mounted on glass slide.

Fig. I - *Tragia plukenetii* R. Smith

T.S of leaf

The leaf shows dorsiventral structure. Upper and lower epidermis is unilayer, rectangular, oval cells, covered with thin cuticle. Trichomes or stinging hairs are large, unicellular with a prominent lumen and spiny apex. The trichomes are more on lower side of midrib (i.e., ventricular side). Lamina composed of single layer of palisade parenchyma; 3-4 layers of spongy parenchyma. Below the upper epidermis, a single layer of elongated, compactly arranged palisade cells are present and the palisade tissue is continued in the midrib region. The mesophyll of the lamina is filled with chloroplasts. Prisms of calcium oxalate crystals with intermittent vascular strands are seen very often in the mesophyll.

The outline of midrib is convex at ventral surface and slightly curved at dorsal surface. Epidermis is followed by 3-5 layers of collenchymatous cells at both surfaces. Steel composed of collateral vascular bundles. Prism and rosette calcium oxalate crystals present in midrib and spongy parenchyma. The surface preparation shows parasitic stomata. (Fig. II a)

T.S of stem

The outline of stem shows a wavy margin. Epidermis composed of 2-3 layered thick walled rectangular cells compactly arranged; 12-15 wavy ridges are present; at few places epidermis shows the presence of trichomes or stinging hairs. Cortex is differentiated into two distinct zones of chlorenchyma and parenchymatous tissues. Below each wavy ridge 5-6 layers of thick walled collenchymatous tissue is present. Prism and rosette type of calcium oxalate crystals are confined to chlorenchymatous tissue and pith region. Bunches of non-lignified fibres observed in parenchymatous cells. Cambium is absent. A well developed collateral and endarch type of vascular bundles are present. Xylem shows secondary characters and present as a continuous band and made up of vessels, parenchyma and thick walled fibres. Secondary phloem made up of phloem fibres and parenchyma. The pith composed of loosely arranged parenchymatous cells and consists of prisms of calcium oxalate crystals (Fig. II b).

T.S of root

Root shows clearly circular outline; cork consisting of 3-5 layers, tangentially elongated thick walled cells. Outer layer cells are filled with brownish content and inner layer are colourless. Cortex is made up of polygonal thin walled parenchymatous cells. Rosette of calcium oxalate crystals and non-lignified fibres in a group of 5-10 present abundantly. Fibres consist of concentric striations with prominent lumen. Secondary phloem composed of sieve tubes, parenchyma and fibres. Secondary xylem occupies major part of root composed of xylem vessels, parenchyma and fibres; vessels are rounded, polygonal or radially elongated either single or in pairs. Medullary rays are one or two cells wide, radially elongated and thick walled. Rosette of calcium oxalate crystals present in medullary rays and xylem parenchyma. Pith is made up of non-lignified parenchymatous cells (Fig. II c).

Powder microscopy

The following powder microscopic characters observed in the order of merit (Fig. II d): i. Unicellular trichomes or stinging hairs with a prominent lumen and spiny tip. ii. Non-lignified fibres with uniform thickness present

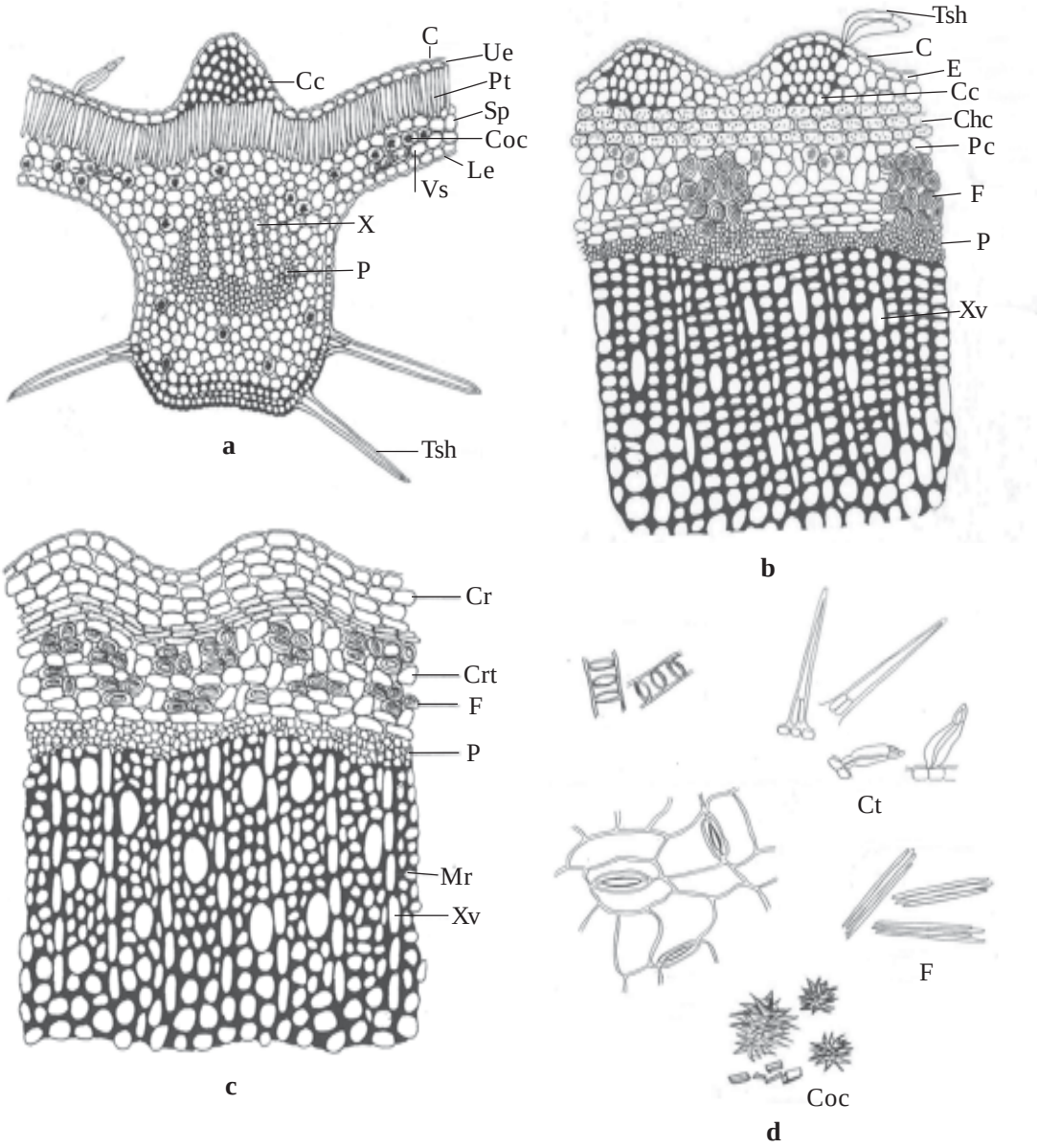

Fig. IIa-d - *Tragia plukenetii* R. Smith

a TS of leaf (X200); **b** TS of stem (X 200); **c** TS of root (X200); **d** Powder characteristics (X200)

C - Cuticle; Ue - Upper edpidermis; Cc - Collenchyma; Pt - Palisade tissue; Sp - Spongy parenchyma; Coc - Calcium oxalate crystals; Le - Lower epidermis; Vs - Vascular strand; X - Xylem; P - Phloem; Tsh - Trichomes or stinging hairs; E - Epidermis; Chc - Chlorenchyma; Pc - Parenchyma; F - Fibres; Xv - Xylem vessels; Cr - Cork; Crt - Cortex; Mr - Medullary rays; V - Vessels; Ct - Covering trichomes

in groups of three to five. iii. Parasitic stomata. iv. Prisms and rosette of calcium oxalate crystals. v. Vessels of reticulate thickenings. vi. Fragments of palisade tissue.

Qualitative phytochemical examination

The dried alcoholic extract was subjected to phytochemical screening[16, 17] for identification of phytochemical constituents and the results are presented in Table 1.

TABLE 1
Qualitative phytochemical analysis *T. plukenetii*

Chemical test	Inference
1. Alkaloids	
- Dragendroff's test	-
- Wagner's test	-
- Hager's test	-
- Mayer's test	-
2. Glycosides	
- Borntraggers test	-
- Baljet test	-
- Legal test	-
- Foam test (for saponins)	-
- Fluoresence test (for coumarins)	-
3. Carbohydrates	
- Molischs test	+++
- Benedics test	++
- Fehlings test	++
- Barfoeds test	-
4. Flavanoids and Phenolic compounds	
- Shinoda test	-
- Alkaline reagent test	++
- Lead acetate test	+++
- Ferric chloride test	+++
- Zinc-hydrochloric acid test	+++
- Vanillin-hydrochloric acid test	++
5. Steroids	
- Liebermann-Burchard test	+++
- Salkowski test	++
6. Proteins and amino acids	
- Millons test	-
- Biuret test	-
- Ninhydrin test	-
- Xanthoprotic test	

Quantitative microscopy

The vital quantitative microscopic leaf constants like vein-islet, vein termination number, palisade ratio and stomatal index were carried out according to the standard method (Table 2).[14]

Ash values

The determination of total ash, acid insoluble ash, water soluble and sulphated ash values were determined separately as per the Indian pharmacopeia[11b] and results tabulated in Table 3.

Conclusion

The present study on pharmacognostical characters of *Tragia plukenetii* R. Smith highlights useful information in regard to its correct identity and help to differentiate from closely related other species of *Tragia*. The presence of large, unicellular trichomes and stinging hairs with prominent lumen along with parasitic stomata are the important observation

TABLE 2
Quantitative microscopy of *Tragia plukenetii* leaf

Leaf constants	Value
Stomatal number	112-196-300
Stomatal index	15-26-37
Vein islet number	23-20-32
Vein termination number	23-42-60
Palisade ratio	5-6

*Results are average of triplicate

TABLE 3
Ash values (%w/w) of *Tragia plukenetii*

Plant part	Total	Acid insoluble	Water soluble	Sulphated
Leaf	11.68	0.77	0.42	19.93
Stem	12.4	5.23	3.3	22.9
Aerial parts	12.3	2	2.91	15.76

*Results are average of triplicate

in leaf. The presence of non lignified fibres and collenchymatous tissue below the wavy epidermal ridges is a characteristic observation of stem. The steroids and flavonoids and their glycosides are present in alcoholic extract. The other parameters observed are also useful for identification of the plant.

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ŚAṆA - A SUTURING MATERIAL IN OPERATED CASES OF INGUINAL HERNIA - AN EVALUATION

Sudeep* and Murlidhara Sharma**

Abstract: Suturing materials are the most common biomaterial used in surgery. The scope and future perspectives for surgical suture materials appear to be vast. This study is an attempt to address śaṇa (*Crotalaria pallida)* stem fibers as suturing material in operated cases of inguinal hernia. 22 patients were randomly selected and divided into two groups. Skin closure in 12 patients of trial group was done by thread prepared by śaṇa fibers and the control group of 10 patients with cotton thread. The trial group showed good results in parameters like edema, restoration of daily activities than control group. The study proves that śaṇa stem fibers can be made an acceptable suturing material and it can be used safely in external wound closure in inguinal hernia and that śaṇa sutures can be used as a safe alternative for cotton thread in skin closure.

Introduction

Sutures are the most widely used wound closure biomaterials. Every operation requires suture materials to close the wound for successful healing. A suturing material should possess and maintain good tensile strength, should be easy to handle, causing minimum tissue reaction and having good knotting security.[1] The Śusrutasamhita represents school of professionalised surgical practice and it was the most advanced school of surgery in the world, in ancient era. Śusrutasamhita advises suturing in fresh, uncomplicated, deep and wide open wounds.[2a] It mentions practices of sīvanakarma using different plant and animal origin sutures. Śaṇa was one of the plant origin suturing materials used by Śusruta.[2b] Synthetic sutures are more expensive than natural sutures and today's environment dictates to provide inexpensive and effective health care maintaining quality standards. Therefore, an inexpensive suture with good performance is the need of the day. *Crotalaria* species are found worldwide, growing mainly in tropical region and śaṇa fibers are easy to obtain. This study is an attempt to bring focus on the efficacy of śaṇa as suture material in the operated cases of inguinal hernia for external wound closure.

Objectives

- To process the śaṇa fibers to make it an acceptable suturing material,

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- study its physical properties at various stages,
- To note its effects as suturing material and compare it with the standard cotton thread in external wound closure in inguinal hernia.

Materials and method

Fibers were isolated from the stem of śaṇa (*Crotalaria pallida*), threads prepared and sterilized. 22 patients irrespective of age and sex, who were posted for the elective surgery of inguinal hernia, were selected. In control group, skin closure of 10 patients was done by cotton thread No.10 and in trial group, skin closure of 12 patients by śaṇa sutures.

Inclusion criteria

- Elective surgery for inguinal hernia (unilateral or bilateral under local/spinal/ general anesthesia)
- Either sex, between 20-60 years of age.

Exclusion criteria

- Systemic diseases like Diabetes Mellitus, Hepatitis, Tuberculosis, HIV infection.
- Recurrent hernia
- Emergency surgical indications

Assessment criteria

Physical properties of the śaṇa fiber were measured in Central Silk Technological Research Institute, Central Silk Board, Bangalore.

Diameter / Tensile strength: - Before and after autoclaving.

Assessment was done on subjective and objective parameters and all the criteria were graded arbitrarily (Table 1).

Duration: - Patients were assessed in the post operative period till the removal of sutures. Follow up was done after one week from the day of removal of sutures.

TABLE 1

Gradation of subjective and objective parameters

Parameters	Gradation
1. Subjective parameters	
a) Pain	
- No pain	0
- Pain only on movement	1
- Pain on rest	2
- Severe pain (requires analgesics intervention)	3
b) Restriction of daily activities	
- No restriction	0
- Mild restriction or discomfort only on climbing stairs	1
- Capable of walking >100 meters on even surface	2
- Unable to walk >20 meters on even surface	3
- Inability to wake up from bed	4
2. Objective parameters	
a) Discharge	
- No discharge	0
- Spotting	1
- One layer of gauze is wet	2
- Two layers of gauze are wet	3
- Need change of dressing more than once a day	4
b) Edema over wound edges and point of suture pathway	
- No edema	0
- Edema	1
- Extending <1 cm wound edges	2
- Extending <2 cm wound edges	3
- Extending >3 cm wound edges	4
c) Infection	
- Absent	0
- Present	1
d) Days taken for wound healing (No gaping of wound on suture removal)	
- Complete suture removal:-	
- on or < 4 days after surgery	1
- on 5th day after surgery	2
- on 6th day after surgery	3
- on 7th day after surgery	4
- on 8th day after surgery	5
- on 9th day after surgery	6
- on 10th day after surgery	7

Thread preparation

The method of extraction of śaṇa fibers is not available in āyurvedic literatures.

Retting: - It is the stage in which water and microbial action are employed to separate the bast fibres from the woody core. Cleansed śaṇa stems are completely immersed in container with clean water and stored in clean environment.

Isolation: - Single strands of śaṇa fibres are separated gently with needle, rinsed in fresh water, dried in shade and preserved in polythene cover.

Preparation of suture material

Four monofilaments of śaṇa fibres of equal length are twisted and wound around the rubber tube simultaneously, maintaining firm grip and equal tension throughout. Terminal portions with fraying ends are trimmed off to obtain sharp end. It is sterilized by autoclaving and stored in sterile steel container. (Fig. I a & b)

Discussion

Physical properties

Length: - Standard routine surgical sutures are available in length of 76 cm with needle, 152 cm without needle and up to 300 meters reel in unsterile form. Surgical cotton thread is available in 22 meters reel in unsterile form which is divided as per the requirement and autoclaved and used for closure. Routine average length yield of śaṇa thread is about 25-50 cm. Maximum length of śaṇa suture obtained was 60 cm. On comparison with standard surgical sutures, śaṇa sutures are a step behind in this regard. This is due to manual preparation of sutures and it cannot be compared with industrial manufacture of cotton thread.

Diameter: - The accepted surgical practice is to use the smallest diameter suture that will adequately hold the wound edges. This minimizes trauma on passage of sutures into tissues and ensures minimum mass of sutures is left in the body. USP System classifies sizes of all types of suture materials. The USP size is related to a specific diameter range necessary to produce a certain tensile strength. The smaller the size, the lesser is the tensile strength. The śaṇa suture was prepared by twisting its 4 single filaments. Therefore, śaṇa

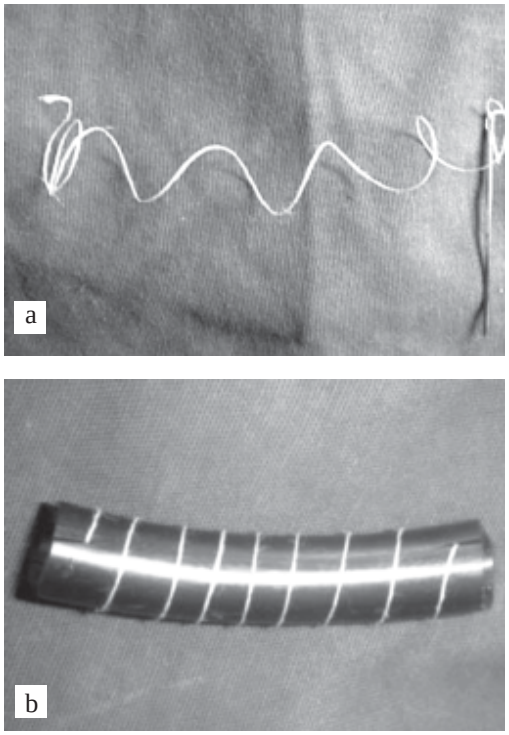

Fig. I a & b - Śaṇa *(Crotalaria pallida)*

a Suture material; b Autoclaved thread

sutures are multifilament in construction. Average diameter 0.35 to 0.399 mm comes under 0 USP size. Diameter of śaṇa suture in the present study were under the 0 USP size. Comparison of diameter of śaṇa sutures at different stages is shown in Table (2).

As per the USP classification of non-absorbable surgical sutures śaṇa (an erect herbaceous shrub) belongs to Class II sutures as it is a natural plant origin suture material.[3]

Tensile strength: - All sutures must meet the minimum knot-pull tensile strength requirements as defined by the USP and tensile strength is directly proportional to the diameter of suture. Average knot pull tensile strength of Class II, 0 USP size suture is 14.2N.[3] Manually prepared śaṇa sutures were only about 3N less than the tensile strength requirements as defined by the USP for Class II, 0 USP size sutures. Śaṇa sutures fails to meet the minimum knot pull tensile strength requirements as defined by the USP. Śaṇa sutures maintained optimum tensile strength so as to hold the tissues until primary healing occurred. Comparison of breaking load and tenacity of śaṇa thread at different stages is shown in Table 2.

TABLE 2
Comparison of diameter, breaking load and tenacity of śaṇa thread at different stages

Physical properties	Single filament	Before Auto-claving	After Auto-claving
Diameter	0.28 mm	0.40 mm	0.38 mm
Breaking load	3.0	10.1	11.1
Tensile strength (N)	12.0	8.9	11.0

Shelf-life: - Śaṇa sutures were used within 3 months of autoclaving and sutures maintained adequate tensile strength over duration of 3 months.

Memory: - Śaṇa sutures have low memory which facilitates easy handling of sutures. No single suture has become untied after knot placement.

Capillarity: - Śaṇa sutures exhibit capillary action. Multifilament suture materials exhibit capillarity and therefore have an increased ability to take up bacteria, resulting in an increased risk of infection. But no patients in trial group suffered from infection.

Knot security: - Śaṇa sutures exhibit good knot security. Knot slippage was not observed in any patients of trial group cases until the suture removal. This is due to its multifilament construction and multifilament sutures offer good knot security.

Tissue penetration: - It offers mild-moderate tissue drag. This is due to fraying of fine fibers throughout the length of śaṇa suture. Natural coating materials may be utilized, particularly for reduction in tissue drag of twisted śaṇa sutures.

Other description

Post operative pain: - On the first postoperative day, analgesics were administered to six patients in trial group and eight patients in control group. From 2nd day onwards, no patients were administered analgesics in both trial and control group. The difference in post operative pain on day 3 and day 5 in trial group and control group was statistically significant.

By this it can be inferred that śaṇa induces less tissue irritation.

Restoration of daily activities: - The difference in restoration of daily activities on day 5 and on the day of removal of sutures in trial group and control group was statistically significant. Trial group patients showed good recovery in restoration of daily activities.

Discharge: - The difference in discharge between control group and trial group was statistically not significant

Edema: - The difference in edema on day 5 and on the day of removal of sutures in trial group and control group was statistically significant. Śaṇa sutures induce less tissue irritation.

Infection: - No patient in trial group showed reactionary changes and signs of marked inflammation.

Tissue reaction: - The initial reaction of the tissues is a reflection of the amount of injury inflicted by passage of the needle and suture. Assuming the same technique, tissue, and other reactive factors such as absence of infection, the reaction will be the same for all sutures during the first five to seven days. Significant inflammation reduces the resistance to infection and delays the onset of wound healing. The type of material and the suture size are the major factors that determine the reactions. Śaṇa sutures exhibits mild to moderate tissue reaction and on comparison with cotton thread No.10, it exhibits less tissue reaction and there was no delay in wound healing.

Days for healing: - Sutures were removed after establishing good tensile strength of wound edges and primary wound healing. In 1 patient in the trial group, sutures were completely removed on 4th day after surgery. Complete removal of sutures was done on 5th day in 6 patients of control and 8 patients of trial group. Complete removal of sutures was done on 6th day in 4 patients of control and 3 patients of trial group. This suggests that the course of healing was almost same in both the groups. The variation was statistically not significant. Comparison of days taken for wound healing between trial and control group is shown in Table 3 (Fig. II a-f & III a-f).

TABLE 3
Comparison of days taken for wound healing

Days taken for wound healing	Control group (n=10)	Trial group (n=12)
4	0	1
5	6	8
6	4	3

Complications: - No patients had stitch abscess, granuloma and wound dehiscence.

Conclusion

Śaṇa fibers can be made an acceptable suturing material and it can be used for skin closure in inguinal hernia. The present study illustrates that physical property of śaṇa sutures are only a step behind the standard requirements. Lacuna in tensile strength requirements can be easily overcome by making use of refined methods of suture preparation. Raw material of śaṇa are easily and abundantly available. It is cost effective, facilitate easy handling, possess and maintain good tensile strength, exhibit good knot security causes minimum tissue reaction. As suturing material, śaṇa sutures are clinically efficacious in skin

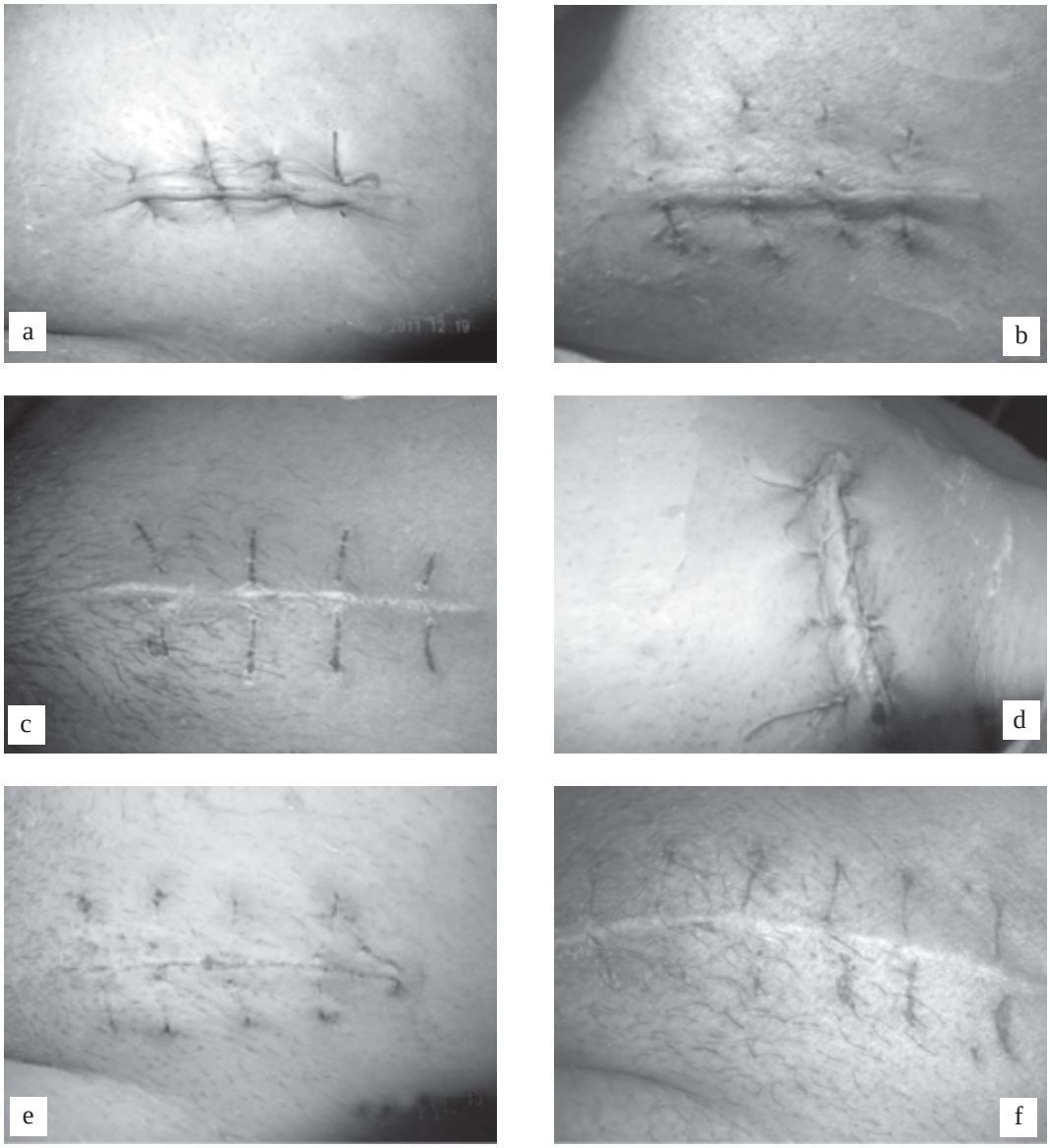

Fig. II a-f:

Days taken for wound healing in Trial group

a) Case No.1:- day 3, b) day 5 (day of removal of sutures), c) day 12 (1 week after removal of sutures);
d) Case No: 2:- day 3, e) day 5 (day of removal of sutures), f) day 12 (1 week after removal of sutures)

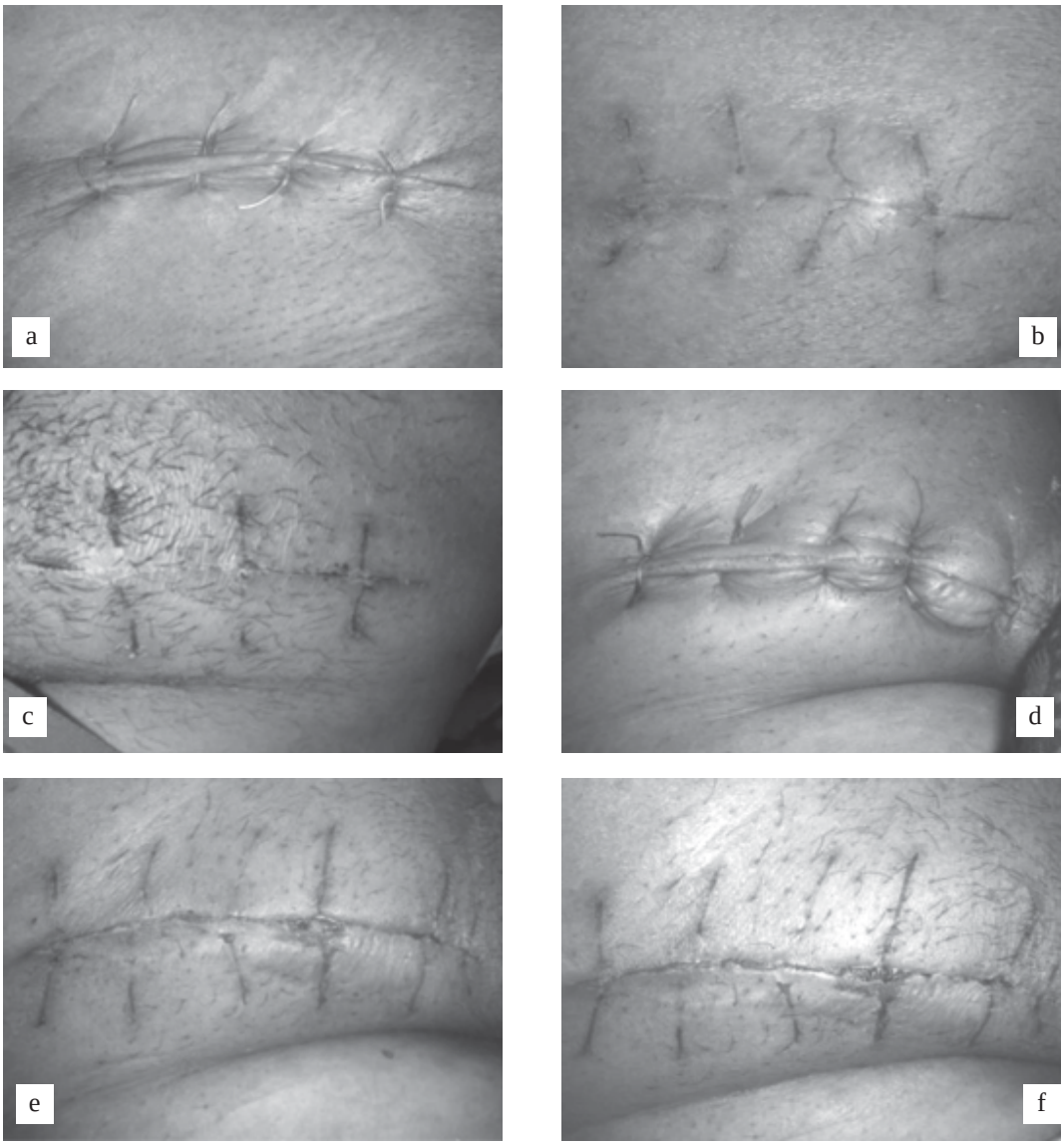

Fig. III a-f:

Days taken for wound healing in Control group

a) Case No.1:- day 3, b) day 5 (day of removal of sutures), c) day 12 (1 week after removal of sutures);
d) Case No: 2:- day 3, e) day 5 (day of removal of sutures), f) day 12 (1 week after removal of sutures)

closure and it can be effectively used as a safe alternative for cotton thread in skin closure. The study justifies the use of śaṇa (*Crotalaria pallida*) as surgical suture mentioned by acarya Śusruta.

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MAHĀPAÑCAGAVYAGHṚITA AND JYOTIṢMATĪTAILA IN THE MANAGEMENT OF VIṢĀDA (DEPRESSION) - A PILOT STUDY

Rao BCS and S. Sahoo*

Abstract: Viṣāda (depression), one of the nānātmaja vikāra of vāta, is characterized by suppression of mental faculties which causes loss of interest, social withdrawal, loss of intellect and incapability to think. This leads to disturbance in personal, familial and social harmony. A study was conducted on 16 patients of viṣāda to assess the clinical effectiveness of Mahāpañcagavyaghṛta along with Jyotiṣmatītaila. Significant improvement was seen in the clinical parameters and Hamilton Rating scale for depression as well. Almost all the signs and symptoms found to be improved in all the patients. There was good response in 56.3%, fair response in 25% and poor response in 18.7% of cases.

Introduction

Viṣāda is one of the vāta nānātmaja vikāra and one of the mānasika roga described in āyurvedic literature. The symptoms of this disease are similar with that of depression. Depression is a condition in which the person's mood is affected. This condition manifests major symptoms like depressive mood and loss of interest in usual pursuits along with other symptoms like loss of appetite, poor intellect and changed sleep pattern (hypersomnia or insomnia).

Need and significance of the study

In viṣāda, suppression of mental faculties causes loss of interest, social withdrawal, loss of intellect and incapability to think. This leads to disturbance in personal, familial and social harmony. The prevalence rate of all mental disorders have been seen as 65.4 per 1000 population. Prevalence rates for schizophrenia, affective disorders (depression), anxiety neurosis, hysteria and mental retardation were 2.3, 31.2, 18.5, 4.1 and 4.2 per 1000 population respectively. 15 percent of people diagnosed with depression will commit suicide. It is also observed that the available modern medicines have physical and psychological side effects.

The ayurvedic principle of synthesis of mind, body and soul to consider man as an integrated whole would help to treat mental disorders effectively. Āyurveda mentions various indigenous preparations for the treatment of different mānasika vikāras. Mahāpañcagavya ghṛta and nasya with Jyotiṣmatītaila are mentioned in the classics to pacify both śārīrika and mānasika doṣas predominantly and thereby restores the normal function of manas.

**Advanced Centre for Ayu. in Mental Health & Neurosciences (ACAMH&NS), CCRAS, NIMHANS, Bangalore*

Aim and objective: - To assess the efficacy and safety of Mahāpañcagavyaghṛta and Jyotiṣmatī-taila in the management of mild to moderate depression (viṣāda).

Material and methods

Study design: - An open trial with 16 patients, selected from the Ayurvedic OPD of ACAMH & NS, NIMHANS, Bangalore.

Inclusion criteria: a) Those suffering from mild to moderate depression; b) ambulatory and co-operative; c) either sex between the age group of 21-50 years; d) presenting the symptoms of the disease as per ICD-10 (fulfils criteria of mild to moderate depression); and e) chronicity of illness >1month and <1 year.

Exclusion criteria: a) Patients below 21 and above 50 years; b) cases of severe depression; c) with suicidal tendency; d) secondary depression - systemic disorders like myx-oedema, parkinsonism; e) psychiatric diseases like schizophrenia and dementia; f) organic brain syndrome; and g) history of alcohol or any other drug dependency.

Assessment criteria: - a) Clinical symptomatic relief and b) psychological parameters - The Hamilton Rating Scale for Depression (Hamilton 1960).

Treatment

- Mahāpañcagavyaghṛta (15g) - twice a day before food for a period of 3 months.
- Jyotiṣmatītaila - a) nasya (as vairecanika) - 8 drops in each nostril once in a day for 7 days on empty stomach after sthānika abhyaṅga and sveda; b) nasya (as snaihika) - 2 drops in each nostril twice in a day on empty stomach for a period of 83 days.

Observation and results

Majority of patients belonged to the age group of 21-30 years; 10 males; and 9 cases with kapha-vāta prakṛti. Distribution of patients according to age, sex and prakṛti is shown in Table 1.

The improvement in clinical parameters such as depressed mood, loss of interest, etc. and clinical parameters based on Hamilton Anxiety Rating Scale were statistically highly significant (Tables 2 & 3). The overall result of the therapy is shown in Table 4.

Discussion

Manas and śarīra are given equal importance in āyurveda. As there are three śārīrika doṣas i.e. vāta, pitta and kapha (factors which control physical well being), there are three mano-guṇas i.e. satva, rajas and tamas (factors which

TABLE 1
Distribution of patients according to sex, age and prakṛti (n=16)

Description	No. of patient	%
1. Sex		
- Male	10	62.5
- Female	06	37.5
2. Age		
- 21-30	08	50
- 31-40	05	31.2
- 41-50	03	18.8
3. Prakṛti		
- Kapha-vāta	09	56.3
- Kapha-pitta	04	25.0
- Vāta-pitta	03	18.7

TABLE 4
Overall results

Results (n=16)	No. of patient	%
1. Good response	09	56.3
2. Fair response	04	25.0
3. Poor response	03	18.7
4. No response	00	0.0

TABLE 2
Effect of therapies on clinical parameters in patients of viṣāda

Clinical parameters	Mean score		% diff.	Mean diff.	SD +	SE +	't'	P
	BT	AT						
Depressed mood	5.9	1.9	67.8	4.0	2.65	0.23	17.1	<0.001
Loss of interest and enjoyment	6.1	3.0	50.8	3.1	0.91	0.08	37.7	<0.001
Reduced energy & decreased activity	5.0	1.8	64.0	3.2	1.27	0.11	16.4	<0.001
Reduced concentration	5.4	2.5	53.7	2.9	3.03	0.27	9.37	<0.001
Reduced self-esteem and confidence	4.2	1.9	54.7	2.3	1.9	0.27	8.5	<0.001
Ideas of guilt and unworthiness	3.6	1.7	52.7	1.9	1.8	0.16	11.2	<0.001
Pessimistic thoughts	2.8	1.1	60.7	1.7	1.3	0.16	7.4	<0.001
Disturbed sleep	4.8	2.0	58.3	2.8	4.05	0.36	9.09	<0.001

TABLE 3
Effect of therapies on clinical parametersbased on Hamilton Rating Scale

Parameters	Mean score		% diff.	Mean diff.	SD +	SE +	't'	P
	BT	AT						
Depressed mood	3.0	1.2	60.0	1.8	0.59	0.12	12.6	<0.001
Feeling of guilty	2.5	1.1	56.0	1.4	0.80	0.16	10.5	<0.001
Suicide	0	0	0	0	0	0	0	0
Insomnia early	1.5	0.5	66.6	1.0	0.54	0.14	8.4	<0.001
Insomnia middle	1.7	0.6	64.7	1.1	0.70	0.13	16.8	<0.001
Insomnia	1.2	0.4	66.6	0.8	0.52	0.15	9.6	<0.001
Work and activities	2.2	0.9	59.1	1.3	0.78	0.24	5.0	<0.001
Retardation: Psychomotor	1.2	0.4	66.6	0.8	0.78	0.24	5.0	<0.001
Agitation	0	0	0	0	0	0	0	0
Anxiety (psychological)	2.2	0.8	63.6	1.4	0.80	0.16	10.5	<0.001
Anxiety somatic	2.2	0.7	68.1	1.5	0.67	0.13	12.8	<0.001
Somatic symptoms (GI)	1.7	0.8	52.9	0.9	0.68	0.12	18.8	<0.001
Somatic symptoms general	1.7	0.7	58.8	1.0	0.54	0.14	8.4	<0.001
Genital symptoms	1.2	0.4	66.6	0.8	0.78	0.24	5.0	<0.001
Hypochondriasis	1.4	0.6	57.1	0.8	0.27	0.06	11.8	<0.001
Loss of weight	0	0	0	0	0	0	0	0
Insight	0.7	0.3	57.2	0.4	0.77	0.19	4.8	<0.001
Diurnal variation	1.6	0.7	56.3	0.9	0.24	0.06	14.7	<0.001
Depersonalization & derealization	0	0	0	0	0	0	0	0
Paranoid symptoms	0	0	0	0	0	0	0	0
Obsessional & compulsive symptoms	0	0	0	0	0	0	0	0

control vital energies or mental well being) also. These śārīrikadoṣas and mānasikaguṇas are inter-related. Vitiation of either of these causes derangement of the other. Any psychiatric disorders are caused by imbalance in mānasika doṣas. Vitiation of rajas and tamas affects satva guṇa and leads to mental disturbance.

One of the causative factors of viṣāda described in āyurveda is mandaceṣṭa [reduced psychomotor activity/sedentary habits], and by consumption of food that vitiate kapha, kapha along with uṣṇa [heat] gets increased in hṛdaya, impairs intellect and memory, confound mind and causes the symptomology comparable with that of depression.

Based on the type and degree of doṣic involvement, āyurveda mentions various treatment modalities for mānasikaroga. Śodhanacikitsa like vasti, virecana and vamana are administered to eliminate the morbid doṣa and to bring about the mental harmony. Śamanauṣadha and rasāyanas are administered after śodhana in order to preserve and promote the poised state of mind.

Conclusion

Nasyakarma with Jyotiṣmatītaila was administered (as a śirovirecana) to correct the doṣic imbalance. This measure helped in eliminating the morbid doṣa causing occlusion of manovahasrotas. Once the manovahasrotas got cleared, Mahāpañcagavyaghṛta along with Jyotiṣmatītaila (pratimarśanasya) was administered as a śamanauṣadha (palliatives) and rasāyana (tonics) therapy to establish doṣic balance and normal mental equilibrium. The therapy with Mahāpañcagavyaghṛta and nasya with Jyotiṣmatītaila showed significant results in patients suffering with mild to moderate depression.

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IMPORTANCE OF DIŚA IN PHARMACY (RASAŚĀLA) SETUP ACCORDING TO ĀYURVEDA AND VĀSTUŚĀSTRA

Vd. Kavita. S. Deshmukh and Vd.Abhijit A. Rumne*

Abstract: Vāstuśāstra is the scientific study of directions, which aims at creating an equilibrium by balancing the different elements of nature and using them for the benefit of humans. It can virtually be applied to all sets of construction, be it a house, a particular room, temple, commercial complex or industry. This paper is an attempt to briefly highlight the importance of diśa in pharmacy (rasaśāla) setup according to āyurveda and vāstuśāstra.

Introduction

There are many references to diśa (direction) for pharmacy (rasaśāla) setup in āyurvedic texts such as how the place, soil, surrounding environment, water supply, etc. should be. One of the fulcrums of āyurveda is the tenet of pancamahābhuta which has very correlation with diśa. Rasaratnasamucchayam elaborates the importance of diśa such as suitable sites of departments (sections), which side is preferable for typical treatments, in other words, it mentions that agnikarma should be done in āgneyakoṇa (south-east side), pāṣāṇakarma on dakṣiṇakoṇa (south side), kṣāḷaanādi karma in paścimakoṇa (west side), etc.[1]

Natural direction or diśa is important in all sets of construction, be it a house, room, temple, commercial complex or industry. There are four chief principles and four secondary to make the total eight directions; adding the upper and the lower directions makes them ten. They are: i) pūrva (east), ii) āgneya (south-east), iii) dakṣiṇa (south), iv) nairṛtya (south-west), v) paścima (west), vi) vāyavya (north-west), vii) uttara (north), viii) īśānya (north-east), ix) ūrdhva (zenith) and x) adhara (nadir) (Fig. I)

Logically, it is interesting to understand the importance of directions when linking up the characteristics and the science. Constructing homes and temples have their importance of direction, so also industries should be built considering the importance of diśa.

Industry (pharmacy/rasaśāla)

The following directions are given in the case of building of pharmacy (Fig. II):

- The plot at which the Industry is going to be built should be rectangular or triangular in shape with big compound wall.
- Pharmacy should be placed at nairṛtya (South-West) direction of that plot.

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- The constructed area should be ¼ of the plot and rest of the area should be kept empty.
- The compound wall of dakṣiṇa side should be broad and heighted.
- Large plants should be planted on dakṣiṇa and paścima side of the pharmacy.
- White and blue colours are ideal for exterior to the pharmacy.

Pūrva (East)

Āyurveda: - This direction is related to God Indra; Element = Fire, Planet = Sun. All the instruments used in rasaśāla should be kept in this direction.

Vāstuśāstra**:** - Pūrva means starting of everything. It is related to god Ravi/Surya, the source of a great energy, the solar energy. Ravi extends the morning welcome with good health, intelligence, concentration and method of thinking properly. To catch the benefits of morning rays we must keep the door, entrances, garden and windows oriented to East

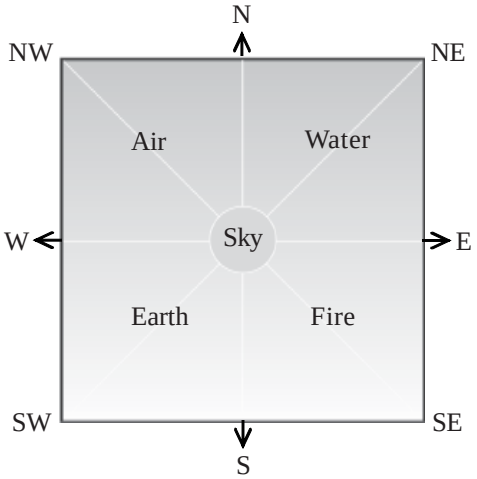

Fig. I Directions and their significance

direction of vāstu and no materials be dumped on this side. The East side must be kept always clean and smooth.

Agneya (South-East)

Āyurveda:- This direction is related to God Agni; Element = Fire, Planet = Venus. All the heating materials (agnikarma) bhatti, cullika, puṭayantra, gas, etc should be kept in this direction. Chimni should be placed above this department for outlet of fumes.

Vāstuśāstra:- All heating units like kitchen, boiler, electric motors, generators, transformers, etc should be placed in this direction. The location of kitchen should be on this side.

Dakṣiṇa (South)

Āyurveda**:** - This direction is related to God Yama; Element = Earth/Fire, Planet = Mars. Store room, registration room, waiting hall, etc. should be built in this direction.

Vāstuśāstra:- Logical meaning of this direction is 'kṣīṇa'; this is the direction of Yama, the god of death i.e. making loss of health and wealth. This direction can be used for dumping old material or waste product.

Nairṛtya (South-West)

Āyurveda: - All the heavy instruments like oven, tablet press, grinder, pulvariser, mixer, coating pan, etc. should be kept in this direction. Resting room should be on this side.

Vāstuśāstra:- This direction is related to Weight. So, all the bulky material or equipments should be kept in this direction. The bed rooms in this direction is said to be good for family life.

Paścima (West)

Āyurveda:- Prakṣāḷana karma, store room for

North-West • Side entrance for loading and unloading • Finished products • Toilet • Guard room • Staff quarters • Parking for trucks, etc.	**North** • Main entrance • Finished products • Office owner should face East or North • Treasury	**North-East** • Main entrance • Parking for cycles • Borewell • Underground water tank • Temple • Water factor
West • Compound should not be kept vacant • Storage for raw-materials • Storage for heavy machinery • Toilet/septic tank	**Centre** Free and open space	**East** • Office owner should face East or North • More open space • Light jobs
South-West • Heavy machinery • Store for raw materials • Office of MD or owner or Chief decision maker	**South** • Never keep vacant • Store for heavy machinery and raw materials	**South-East** • Transformers, boilers, generators, etc • Guard room • Staff quarters • Fire elements

raw drugs and other vessels should be placed in this direction.

Vāstuśāstra:- This direction indicates antima (end of everything or wastage). This is right direction for dumping the waste. This side is ideal for bathrooms, toilets, staircases and store rooms. Trees can be planted on this side.

Vāyavya (North-West)

Āyurveda:- This direction is related to God Agni; Element = Fire, Planet = Venus. Drying room i.e. store room should be placed on this direction.

Vāstuśāstra: - This direction denotes Vāyu i.e. the Wind. So, this direction is ideal for drying room, storage of grains i.e. store room. Maximum windows have to be provided on this side.

Uttara (North)

Āyurveda: - This direction is ideal for store room to keep final products and all rasādi dravyas.

Vāstuśāstra:- This direction literally means Answer or Solutions. This direction is dedicated to lord Kubera and Dhana i.e. Wealth can be received by keeping doors and windows in this direction. This is the most ideal direction for living room and water storage.

Īśānya (North-East)

Āyurveda:- This direction is good for water unit and wash rooms. Rasaliṅga should be placed on this direction.

Vāstuśāstra:- This direction is the dwelling of god himself. Hence place for god (temple) and veranda. On placing God in this direction the vāstu will receive good health, wealth, good understanding and respect. It is preferable to have the Well or Water source in this direction.

Ūrdhva (zenith)

This direction means the Sky i.e. Suspension. It is not possible to construct the buildings or any vāstu in this direction.

Adhara (nadir)

This direction means underground space. It is advisable that residential homes should not have basement. Otherwise the families suffer by losses. (Table 1)

TABLE 1
Significance of various directions

Directions	Elements	Planet	Deity	Significance
1. East	Fire	Sun	Indra	Growth of family, Longevity, name and fame
2. South-East	Fire	Venus	Agni	Health, sexual vitality
3. South	Earth/fire	Mars	Yama	Happiness, success
4. South-West	Earth	Eahu/Ketu	Nairṛti	Character, Head of the family, Strong ability and willpower
5. West	Water	Satrun	Varuna	Reward, Luck
6. North-West	Air	Moon	Vayu	Friends and enemy, supporter, communication and speed
7. North	Water	Mercury	Kubera	Money, wealth, maternal side business
8. North-East	Water	Jupiter	Śiva	Knowledge, wisdom, stability in business, relationships, god blessing
9. Centre	Space		Brahma	All around prosperity

Conclusion

Every science has its uniqueness so also Vāstuśāstra. The study highlights the importance of directions for setting up a rasaśāla (pharmacy). These directions are believed to be auspicious and may be followed as far as possible for opulence and benefits.

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   वह्निकर्माणि चाग्नेये याम्ये पाषाणकर्म च।।
   नैरृत्ये शस्त्रकर्माणि वारुणे क्षाळनादिकम्।
   शोषरं वायुकोणे च वेधकर्मोत्तरे तथा।।
   स्थापनं स्निग्धवस्तूनां प्रकुर्यादीशकोणके।
   पदार्थसंग्रहः कार्यो रससाधनहेतुकः।।
   (र. र. स. ७/३-५)

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VARĀṬIKĀBHASMA AND EARLY MOBILIZATION IN THE MANAGEMENT OF ASTHIBHAGNA WITH SPECIAL REFERENCE TO COLLES' FRACTURE – A SINGLE BLIND PLACEBO CONTROLLED STUDY

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Abstract: Colles' fracture is the commonest fracture in elderly people and is particularly common in women after the age of 45 because of post menopausal osteoporosis. A clinical study on 30 patients was conducted to evaluate the effect of Varāṭikabhasma in Colle's fracture Type I/II (According to Universal Classification). It is found that Varāṭikabhasma possesses potential properties that promote fracture healing by enhancing the rate of callus formation.

Introduction

A Colles' fracture is a distal radius fracture occurring within 2.5 cm of the wrist and typically involves some dorsal angulation at the site of the fracture.[1] This type of fracture is one of the most common fracture sites due to osteoporotic conditions.[2] It mostly results from a 'slip and fall' on an outstretched hand. The incidence of Colles' fracture is 1.7 and 7.3 per 1000 person in men and women, respectively.[3] No detailed description of this disease is available in ancient texts. There are so many names given for the condition associated with fracture in lower end of radius but in universal classification the Colles' fracture is described as that "takes place at about an inch and a half (38 mm) above the carpal extremity of the radius" and "the carpus and the base of metacarpus appears to be thrown backward." Treatment of Colles' fracture is essentially conservative. For an undisplaced fracture, immobilisation in a below-elbow plaster cast for six weeks is the standard treatment. There are so many complications of plaster treatment like impairment of circulation (tight cast), plaster sores, excessive pain, disturbed sleep, recurrence of swelling over toes or swelling over toes or fingers, low grade fever and soakage of the plaster.

Cases of Colles' fracture Type I and Type II (universal classification) were taken for the present trial. Varāṭikabhasma is one of the various drugs described in āyurvedic texts, which promotes healing of fractures. This single blind placebo controlled study was done to evaluate the effect of the drug in early mobilization in the management of Colles' fracture.

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Aims and objectives

- To decrease the period of immobilisation from 6 weeks to 4 weeks in the management of Colles' Fracture Type I & Type II; to regain early and better movement in affected wrist joint; and to minimize post immobilization stiffness associated with this condition.
- To evaluate the effect of Varāṭikabhasma in fracture healing
- To provide cheap and economic drug that promotes fracture healing

Materials and methods

Subjects: - 30 patients who met the inclusion criteria were selected from the OPD/IPD of Salyatantra, National Institute of Ayurveda, Jaipur. All the patients were subjected to physical, general and systemic examinations including aṣṭavidhaparīkṣa, daśavidhaparīkṣa and prakṛtiparīkṣa (based on the features described in classical texts).

Inclusion criteria

- Female patients under 30-65 years of age group
- Cases of Colles' fracture Type I and II, possible to reduce by closed reduction method with or without general anaesthesia

Exclusion criteria

- Below 30 or above 65 years of age
- Cases of TB, Hypertension, Diabetes, Cardiac disorder or some constitutional disorder
- All fracture other than Colles' fracture
- Open and multiple fractures
- Subluxation of the inferior radio-ulnar joint
- Colles' fracture having significant angulation and deformity

Grouping

The selected subjects were randomly divided into two groups viz. A & B, each consisted of 15 patients.

Group A: - Immobilization with POP for 4 weeks along with Varāṭikabhasma (in a dose of 375 mg in capsule form) for 6 weeks along with apakvakṣīra as anupāna.

Group B: - Immobilization with POP for 6 weeks with Placebo (in a dose of 375 mg in capsule form) for 6 weeks along with apakvakṣīra as anupāna.

Study design

In this randomized, parallel and single blind interventional clinical trial, modern methodology and statistic design were suitably adopted. The period of the trial was 6 weeks; and duration of immobilization - 4 weeks with oral drug and 6 weeks with placebo.

Investigations

X-ray: - Standard AP/LAT view of wrist joint was taken on day 1 to diagnose the fracture, its type, severity and prognosis. The follow up X-ray was taken at the end of 4th and 6th week.

Observation during treatment: - Assessment of progress was done weekly and statistical analysis on 0 day, 28th and 42nd days. Presentation of observation did through tables and graph.

Follow up: - Follow up done every 15th days up to 2 month after completing treatment to review the progress of improvement or any deterioration associated with Colles' fracture.

Assessment criteria

The improvement was assessed mainly on the basis of relief in the cardinal sign & symptoms of disease. Assessment criteria other than Visual Analogue Scale (VAS) for pain was designed by the research team in accordance to the features of various sign and symptoms

of fractures as mentioned in the Śusrutasamhita.

Subjective/objective criteria: - It is difficult to measure the degree of pain because of variations in terms of expressions, tolerance and threshold of pain in individuals. Pain was assessed on the basis of standard VAS scale. To assess the effect of therapy objectively, all the signs and symptoms along with pain was given score depending on their severity (Table 1)

Range of movement: - Assessment of range of movement of affected wrist joint on the grading system (Table 1) was done by Wagner Pain Clinic in U.K. for Range of Movement of Joint (ROM). The patients were assessed for ROM on BT, 4th and 6th week.

Callus assessment: - The callus formation was assessed radiologicaly by taking X-ray film on the 4th week of the trial and compared both groups. The parameters of gradation are shown in Table 1.

General advise:- i) Keep the part elevated as instructed, ii) active finger movement, iii) watch distal discoloration and numbness if any, iv) do not put or keep anything inside the cast, v) do not wet/cut the cast, vi) inform immediately in case of any discomfort at cast area

TABLE 1
Gradation of subjective and objective parameters

Parameters	Gradation
1. Subjective parameters	
a) Pain	
- No pain	0
- Mild	1-3
- Moderate	4-6
- Severe	7-10
b) Tenderness	
- No	0
- Patient winces	1
- Winces & withdraws affected part	2
2. Objective parameters	
a) Swelling	
- No swelling	0
- Minimal swelling	1
- Mod. swelling without discoloration	2
- Diffuse swelling with discoloration	4
b) Range of movement	
- No joint movement	0
- Slight movement	1
- Half of the ROM	2
- More than half of the ROM	3
- Good but not full ROM	4
- Full in ROM	5
c) Callus assesment	
- Sharp or sclerotic line seen in both projections	3
- Fracture line seen in only one of the projection	2
- Fracture line faintly seen	1
- Fracture line not seen	0

Observations and result

In group A, 78.72% of relief was seen in pain, and 78.10% in group B. This indicates that Varāṭikabhasma has slight analgesic property that can be attributed to the therapeutic characters, particularly its uṣṇa vīrya, and promotion of callus formation in concern to the early and better fracture healing. There was marked reduction in tenderness and swelling. The results indicate the anti-inflammatory effect of the trial drug that can be assigned to its properties like kaṭu rasa, rūkṣa and tīkṣṇa guṇa, uṣṇa vīrya and kaṭu vipāka and thereby its kapha śāmaka character. The range of movement noticed after 6 week in group A & B was 86.20% and 56.25% respectively. This can be attributed to the early discontinuation of immobilisation in Group A. Callus formation was better observed in Group A than in group B. This was because Varāṭikabhasma promotes both on the organic and mineral phase of fracture healing. (Tables 2 & 3, Fig. I)

Varāṭikabhasma is highly crystalline calcium corbonate in the calcite form with presence of trace elements like Mg, Al, K, Fe, and Zn resulting in early regeneration of all connective tissues of mesenchyma origin, namely the fibroblasts, the chondroblasts and osteoblasts involved in the fracture healing and quicker mineralization of the callus. The drug has sandhānīya, raktaprasādaka and rasayana properties also.

Pharmacological action:- Varāṭikabhasma contains Phosphate, Fluride and Carbonate of Calcium, Magnesium and Phosphate of Maganese. The analysis shows that the overall process of formation of Kapardikabhasma involves decorbonation of calcium corbonate in aragonite form and reformation of the calcium carbonate in the calcite form. This transformation ocurs via formation of calcium hydroxide and calcium oxide as the intermediates. Varāṭikabhasma is thus highly crystalline calcium corbonate in the calcite form with presence of trace elements like Mg, Al, K, Fe, and Zn.[5] The probable mechanism of action in fracture healing can be attributed to the stimulation of the metabolism and increased uptake of the calcium, sulphur, and strontium by the osteoblasts. These trace elements act as antagonists to the glucocorticoid receptor and promote fracture healing. Varāṭikabhasma mobilizes fibroblast and chondroblasts to an injured tissue and

TABLE 3
Comparison of result in both groups

Signs & symptoms	Group		p	Result
	A	B		
- Pain	78.72	78.10	0.3977	NS
- Tenderness	84.09	77.77	0.322	NS
- Swelling	77.77	72.72	0.2511	NS
- Range of movement	86.20	56.25	0.0286	S
- Callus formation	53.48	47.619	0.463	NS

TABLE 2
Statistical assessment of signs/symptoms

Sign/symptoms	Mean			% relief	SD	SE	't' value
	BT	BT	Diff.				
1. Pain							
- Group A	9.4	2	7.5	78.723	1.638	0.4231	17.488
- Group B	9.133	2	7.133	78.102	1.505	0.3887	18.35
2. Tenderness							
- Group A	2.933	0.466	2.466	84.91	0.639	0.165	14.929
- Group B	3	0.666	2.333	77.77	0.723	0.186	12.486
3. Swelling							
- Group A	3	0.667	2.337	77.778	0.816	0.2108	11.68
- Group B	2.933	0.8	2.133	72.727	0.838	0.2153	9.9092
4. Range of movement							
- Group A	1.933	3.7	1.86	93.107	0.941	0.243	7.4075
- Group B	2.133	3.333	1.2	56.25	0.503	0.144	8.2902
5. Callus assessment							
- Group A	2.8667	1.333	1.53	53.488	0.743	0.191	7.9903
- Group B	2.8	1.466	1.333	47.619	0.723	0.186	7.1351

n=15 (in each group); p=<0.0001 - Highly Significant

promotes fracture healing. The anabolic steroidal component of Varāṭikabhasma showed a marked influence on the rate of fracture healing by influencing early regeneration of all connective tissues of mesenchyma origin, namely the fibroblasts, the chondroblasts and osteoblasts involved in the fracture healing and quicker mineralization of the callus.

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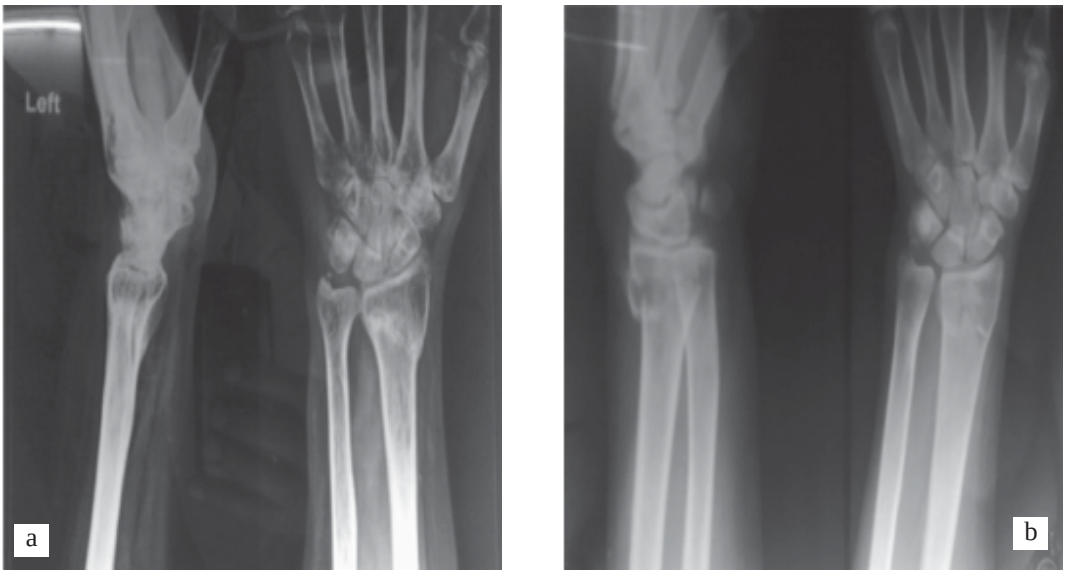

Fig. I X-ray
a Before cast; b After removal of cast

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EFFICACY OF LAVAṆABHĀSKARACŪRṆA - A CRITICAL REVIEW

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Abstract: The effectiveness and the mechanisms of action of crude herbal preparations vary according to their composition and their chemical constituents. An attempt is made here to provide the different claims of Lavaṇabhāskaracūrṇa that has been traditionally using to treat gastrointestinal diseases.

Introduction

Lavaṇabhāskaracūrṇa is a well known medicine used in the management of gastrointestinal disorders. As per Ayurvedic Formulary of India, this formulation is widely used for various disorders such as agnimāndya (digestive impairment), grahaṇi (mal absorption syndrome), vāta-kaphaja gulma (lump due to vāta and kapha doṣa), udara roga (diseases of abdomen/enlargement of abdomen), arśa (haemorrhoids), kṣaya (phthisis), kuṣṭha (diseases of skin), vibandha (constipation), bhagandara (fistula-in-ano), śopha (oedema), śūla (colicky pain), śvāsa (dyspnoea/asthma), kāsa (cough), āmavāta (rheumatism), hṛtśūla (angina pectoris) and ajīrṇa (dyspepsia). The therapeutic values of the ingredient drugs in Lavaṇabhāskaracūrṇa (Table 1) in various disorders are as follows:

Agnimandya

Lavaṇabhāskaracūrṇa contains caturlavaṇa i.e. samudra lavaṇa, sauvarcala lavaṇa, viḍa lavaṇa, and saindhava lavaṇa. The formulation acts as a digestive and appetizer. It dissolves immediately on putting in the mouth and enhances the salivary secretions. It also acts as a catalyst during the digestive process. As it is a hygroscopic in nature it creates lubrication, which helps digestion. It improves the function of pācakāgni by improving the function of pācakapitta and śamanavāyu. It is because of the effect of one of the ingredient drugs coriander which increases the gastric secretion in normal stomach and more in injured stomach.[1] Pippali helps to bring immediate relief from the discomfort caused by gastric wind. Pippali also helps in relieving flatulence and dyspepsia. Carvone present in kṛṣṇajīraka acts as a carminative.[2] Śvetajīraka has reported to be a very good stomachic, appetizer and carminative.[3] Majority of the drugs in Lavaṇabhāskaracūrṇa are appetizers, for this, the preparation is effective in agnimāndya.

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TABLE 1

Properties of ingredient drugs of Lavaṇabhāskaracūrṇa

Ingredients	Properties	Part used	Qty (%)
1. Samudralavaṇa (Sea-salt) (*Sodii muras*)	Rasa - madhura with little tikta; Vīrya - uṣṇa (less); Vipāka - madhura; Guṇa - guru; Karma - vātanulomaka, rucikāraka, laxative; Doṣaghnata - vātakapha śāmaka, pittavardhaka	-	19.51
2. Dāḍimabīja (Pomogranate) (*Punica granatum*)	Rasa - madhura, kaṣāya, amḷa; Vīrya - anuṣṇa Vipāka - madhura, amḷa; Guṇa - laghu, snigdha Doṣa - kaphavātahara; Karma - rocana, kaṇḍughna, krimighna, saṅgrāhi, kaṇṭhya, ārtavapravartaka	Seeds	9.76
3. Saindhavalaṇa (Rock salt)	Rasa - lavaṇa; Vīrya - śīta; Vipāka - madhura; Guṇa - laghu, sūkṣma, snighdha; Karma - śrotogāmitva, chedana, bhedana	-	4.88
4. Viḍalavaṇa (Black salt) (unique sodium chloride)	Rasa - lavaṇa; Vīrya - uṣṇa; Vipāka - madhura; Guṇa - laghu, tīkṣṇa, uṣṇa, rūkṣa; Karma - vātanulomaka, rucikāraka, laxative; Doṣaghanata - vātakapha śāmaka, pittavardhaka	-	4.88
5. Dhānyaka (Coriander) (*Coriandrum sativum*)	Rasa - kaṣāya; Vīrya - uṣṇa; Vipāka - madhura; Guṇa - laghu, tiktakaṭu, uṣṇa, rūkṣa; Karma - agnidīpaka,vātanulomaka, mūtraḷa, dīpana, pācana; Doṣaghanata - tridoṣāmaka	Fruit	4.88
6. Pippali (Long pepper) (*Piper longum*)	Rasa - kaṭu; Vīrya - anuṣṇa; Vipāka - madhura; Guṇa - snighdha, laghu, tīkṣṇa; Doṣa - kaphavātahara; Karma - dīpaniya, śūlapraśamana, anāhaghana, vṛṣya, pācani, jvarahara	Fruits	4.88
7. Pippalīmūla (Long pepper root)	Rasa - kaṭu, tikta; Vīrya - uṣṇa; Vipāka - kaṭu; Guṇa - rūkṣa, laghu, tīkṣṇa; Doṣa - kaphavātahara; Karma - dīpanīya, śūlapraśamana, anahaghna, vṛṣya, pācani	Root	4.88
8. Kṛṣṇajīraka (Black caraway) (*Carum carvi*)	Rasa - tikta, katu; Vīrya - śīta; Vipāka - kaṭu; Guṇa - laghu; Doṣa - pittaśāmaka; Karma - amḷapitta, dāha	Seeds	4.88
9. Patraka (Cassia cinnamom) (*Cinnamomum tamala*)	Rasa - madhura; Vīirya - uṣṇa; Vipāka - madhura; Guṇa - laghu; Doṣa - vātaśāmaka; Karma - aruci	Leaves	4.88
10. Nāgakesara (Cobra's saffron) (*Mesua ferra*)	Rasa - kaṣāya, tikta; Vīrya - anuṣṇa; Vipāka - kaṭu; Guṇa - laghu, rūkṣa; Doṣa - pittakaphaghana; Karma - stambhana, krimighana	Seeds	4.88
11. Tālīsapatra (Himalayan yew) (*Taxus baccata*)	Rasa - madhura, tikta; Vīrya - uṣṇa; Vipāka - kaṭu; Guṇa - laghu, tīkṣṇa, sanighdha; Dosa - vātakaphaghana; Karma - carminative, dīpana, rocana	Leaves	4.88

-/-

Table 1 cont...

Ingredients	Properties	Part used	Qty (%)
12. Amla (Emblic myrobalan) (*Phyllanthus emblica*)	Rasa - strong amḷa; Vīrya - uṣṇa; Vipāka - amḷa; Guṇa - laghu, tīkṣṇa, rūkṣa; Karma - dīpanīya, śūlahara, cakṣuṣya, krimihara; Doṣa - kaphavātahara, pittavardhaka	Fruits	4.88
13. Marica (Black pepper) (*Piper nigrum*)	Rasa - kaṭu; Vīrya - uṣṇa; Vipāka - kaṭu; Guṇa - laghu, tīkṣṇa; Karma - dīpaniya, śūlahara, cakṣuṣya, krimihara; Doṣa - kaphavātahara	Fruits	2.44
14. Sveta jiraka (Cumin seed) (*Cuminum cyminum*)	Rasa - tikta, kaṭu; Vīrya - śīta; Vipāka - kaṭu; Guṇa - laghu; Doṣa - pittaśāmaka; Karma - amḷapitta, dāha;	Seeds	2.44
15. Sunthi (Ginger) (*Zingiber officinale*)	Rasa - kaṭu; Vīrya - uṣṇa; Vipāka - kaṭu; Guṇa - snigdha, laghu; Karma - dīpana, āmavātaghana, śūlahara, vibhandhahara, hṛdya; Doṣa - vātakaphahara	Rhizome	2.44
16. Tvak (Cinnamon) (*Cinnamomum verum*)	Rasa - madhura; Vīrya - uṣṇa; Vipāka - kaṭu, tīkṣṇa; Guṇa - picchila, laghu, tīkṣṇa; Doṣa - kaphavātahara; Karma - rocana, kaṇḍughna, krimighna, saṅgrāhi, kaṇṭhya, ārtavapravartaka	Bark	1.22
17. Ela (Cardamom) (*Elettaria cardamomum*)	Rasa - madhura, tikta; Vīrya - śīta; Vipāka - madhura; Guṇa - laghu, rūkṣa; Doṣa - vātapittaghana; Karma - krimighana, dīpana, rocana	Fruits	1.22

Grahaṇi

In mal-absorption syndrome, the ability of the intestine to absorb nutrients adequately into the bloodstream is decreased. It may refer to mal-absorption of one specific nutrient or for specific carbohydrates, fats, or trace elements (micronutrients). The fact is that digestion and absorption can be divided into 3 major phases: a) the luminal phase, in which dietary fats, proteins, and carbohydrates are digested by secreted digestive enzymes and bile which is also secreted into the lumen; b) the mucosal phase, which is based on the integrity of the membrane of intestinal epithelial cells, purposed to transport digested products from the lumen into the cells; c) post absorptive phase, the phase characterized by transport of reassembled lipids and other extremely important nutrients through lymphatic's and blood circulation. Lavaṇabhāskaracūrṇa affects the mucosal phase of absorption; its ingredient drugs elā and patraka relax the smooth muscle and thereby help transport the digested products from the lumen into the cells. Piperine in marica has been shown to possess diverse biological activities in mammalian system.[4] Many groups of scientific investigators attribute this bio-enhancing property of pepper to its main alkaloid piperine.[5] Ela has shown gastro-protective

property in rats.[6] This is a supportive treatment to the main line treatment of mal-absorption syndrome.

In gulma

Gulma is a term used to describe any palpable hard mass in the abdomen. The bark of tvak has reported to possess mutagenic activity in re–assay in *Bacillus subtilis*. It has carcinogen action.[7] Pippali contains piperine which is able to fight certain infectious parasites. Marica is help fighting germs (microbes) and causes to increase the flow of digestive juices. Some evidences suggest pepper protects against colon cancer.

Udararoga

All the abdominal diseases are due derangement of waste material (malas - feces, urine and sweat and the three doṣas) that are caused by poor digestion and metabolism. Śuṇṭhi is credited for its anti-spasmodic, analgesic, anti-inflammatory and anti-oxidant activities. The active ingredients that are effective for anti spasmodic actions are gingerols and diarylheptanoids.[8] Śuṇṭhi has proven to be effective in inhibiting the intestinal, gastric and colonic motility and its spasmolytic activity is attributed to gingerol that inhibits prostaglandin biosynthesis and seretogenic activities.[9] Śuṇṭhi has inhibitory effects on COX-1 and 2 enzymes and the mechanism of action is hypothesized due to the attenuation of COX-1 and 2 (regulated by the eukaryotic transcription factor NF-Kappa B) and thromboxane–synthesase enzymatic activity.[10] The gingerol acts by interfering with intracellular signaling cascades, those involving NF-Kappa B and mitogen protein kinases.[11] Thomson *et al* has documented significant inhibitory effects of *Zingiber officinale* extract on PG-E2 production.[12]

Hemorrhoids

The lekhana property of ingredient drugs in Lavaṇabhāskaracūrṇa reduces the size in hemorrhoids. The soothing effect of the formulation decreases the pressure of stool on veins and sphincters and thereby lessens pain and bleeding. The uṣṇa, tīkṣṇa and snigdha guṇas of the formulation correct vātaduṣṭi and regulate the function of apānavāyu which breaks samprāpti. The ingredient drugs have laxative effect, which reduces the pressure on haemorrhoidal veins. The four lavaṇa possess lekhana, śothahara, śūlaghna, vraṇaśodhana-ropana, dīpana, pācana and recana properties. Commonly the lavaṇas present in the Lavaṇabhaskaracūrṇa have ādhmāna-vibandha-vraṇa-śothaghna actions. Pharmacological actions of four lavaṇa are analgesic, anti-inflammatory, and antiseptic. The formulation enhances the process of healing by promoting epithelization, reduces inflammation by eliminating tīkṣṇa guṇa of pitta and relieves pain resulting in relaxation of external sphincter muscle; reduces wound contracture by keeping the edges soft by reduced rūkṣata of vāyu. It reduces the risk of secondary infection. Hence it is recommended to use in hemorrhoids with takra. Āmlā, another ingredient, has laxative action, which is important in relieving constipation in hemorrhoids (Kirtikar and Basu, 1981). Its antibacterial and astringent properties prevent infection and help in healing of ulcers (Nadakarni, 1996b).

Fistula-in-ano

Nāgakesara contains xanthones; given orally or intraperitonially has shown to exhibit significant anti-inflammatory activity in normal as well as adrenolectomised rats. Due to faster

rate of healing and reduced or absence of wound contracture phenomenon the ulcer remains open and the secretions which otherwise get collected in and hamper the healing process, get cleaned rapidly. This is a supportive treatment to fistula-in-ano.

Splenic problems

The formulation enhances the action of spleen. The most common symptoms being unable to eat a large meal, feeling discomfort, fullness, or pain on the upper left side of the abdomen. The effect of pippali in the formulation reduces splenic problems. This is a supportive treatment to spleen problem.

Kṣaya

The formulation is effective in pittakṣaya where anorexia is the symptom. Lavaṇabhāskaracūrṇa has a definite appetite-stimulating effect in patients who complaint anorexia as the leading symptom, irrespective of the illness.

Kuṣṭha

In all types of skin diseases, the causative factor is abnormality in digestive juice secretion because of which aggravation of doṣas occurs. The provoked doṣas reach to tiryag siras and vitiate tvak and ultimately cause discoloration of the skin and produce kuṣṭha. The kaṇḍūghna property of dāḍimabīja and tvak is helpful in kuṣṭha.

Constipation

Constipation is a disorder of apānavāyu which causes flatulence and discomfort in heart. The formulation is very effective in such cases and is recommended thrice a day especially with water in the early morning and with ghee at daytime and night.

Śopha

One of the causative factors of oedema is liver disease such as cirrhosis which causes secretion of hormones and fluid-regulating chemicals to change. The problems can lead to fluid retention in the legs and ascites (abdominal cavity). Pippali with other herbs helps to control the liver secretions and fluid regulating chemicals.

Śūla

The causes of abdominal pain include gastritis, non-ulcer dyspepsia, intestinal colic associated with worm infestations, gastroenteritis and irritable bowel syndrome (IBS). Śuṇṭhi has proven effective in inhibiting the intestinal, gastric and colonic motility. Its spasmolytic activity is attributed to gingerol, an active constituent that found to inhibit prostaglandin biosynthesis and serotonergic activity. The combination of these active constituents could be responsible for the synergistic antispasmodic effect.

Śvāsa and kāsa

Śvāsa and kāsa rogas are jaṭharāgnimāndya vyādhis and rasagata āma is present hence dīpana, pācana, vātanulomana and rocana properties help in these diseases. The ingredient drugs of the formulation have dīpana, pācana and rocana properties, which helps to purify the dūṣya. Due to tikta and kaṭu rasa, laghu, rūkṣa and tīkṣṇa guṇa, the formulation has śrotoviśodhana property. In Lavaṇabhāskara cūrṇa, majority of the dravyas have kāsa-śvāsaghna, vātānulomana properties, which cause great relief in about all the symptoms of tamakaśvāsa.

Hṛtśūla

An attack of severe, excruciating pain in retrosternal area in chest that often radiates to the left arm, neck, and adjacent areas is called

angina pectoris i.e. hṛtśūla in āyurveda. Lavaṇabhāskaracūrṇa has antiatherogenic property. Śuṇṭhi and pippali are proved to be potent inhibitors of HMG CoA reducates and thus reduce the synthesis of cholesterol in the system.[13]

Āmavāta

Lavaṇabhāskaracūrna does āmapācana as its pharmacodynamic properties are against the guru, snigdha, picchila, śīta properties of āma. Also, it has some antioxidant property over āma. In śrotoabhiṣyanda, it does śrotośodhana and relieves the symptoms of sandhiśūla, śotha, ālasya and aruci by its analgesic (vedana praśamana) and anti-inflammatory (śothahara) actions. Also the associated symptoms like vibandha, anāha, etc. are reduced by anulomana i.e. purgative property of the drug. As most of the ingredient drugs are vāta-kaphaśāmaka and agnivardhaka, it is suitable for the samprāpti vighaṭana of the disease and to combat the main culprit vāta and kapha (āma) and mandāgni, which are the root source of āmavāta.

Ajīrṇa

One of the common causes of upper gastrointestinal symptoms is non-ulcer dyspepsia (NUD). As gastric acid plays a major role in the pathophysiology of this disease, acid neutralisation/suppression is the main line in GERD (gastro esophageal reflux disease) therapy.

All the ingredient herbs, especially ela, jīraka and dhaniya, have proved to be increased acid secretion. Jīraka protects the colon by decreasing the activity of ß-glucuronidase and mucinase; śuṇṭhi stimulates gastric motility (efficiency of moving food through the digestive tract), relieves indigestions, and promotes digestion. Ela has shown gastroprotective property in rats. The synergistic actions the ingredient drugs are proved to be benefit in gastrointestinal system.

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JĀTAKARMASAMSKĀRA
(Ayurvedic approach to immunization)

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Abstract: Immunization is an important subject in pediatrics today. Kaumārabhṛtya, one of the eight branches of āyurveda, highlights some aspects of immunization which is not understood properly or not practiced today in its original manner. The basis of this immunization is also the tridoṣasiddhānta. Jātakarmasamskāra, the very first samskāra that a child undergoes after birth, consists of administration of a mixture of madhu-ghṛta as the first feed. The salient aspect behind this practice is immunizing the child against vātaduṣṭi. This article briefly discusses the concept and meaning of jātakarmasamskāra.

Introduction

Kaumārabhṛtya is one of the eight branches of āyurveda. The word 'kaumārabhṛtya' is composed of two words: kumāra and bhṛtya. The word 'kumāra' is used in Vedas in the sense of child, boy, youth and son, while in Sanskrit literature, this word is specially used for Kārtikeya, the son of lord Śiva. The children of royal families were also called 'kumāra'. The word 'kumāra', is made up of two words, 'ku' and 'māra'. According to the lexicon of Monier - Williams, the word 'ku' is used as a prefix implying deterioration, depreciation or deficiency. The word 'mār' is derived from the root 'mri' means easily dying. In Sanskrit literature the word 'mār' is used also as a synonym of the God of love (kāmadeva). The word 'bhṛtya' is derived from the root 'bhṛṇe bharaṇe' which means 'to bear (in womb)', wear, nourish, support and maintain. Thus it is clear that Kaumārabhṛtya means care of a woman in pregnancy as well as care of a child after birth. To make the idea clear, Śusruta has clearly defined the word 'kaumārabhṛtya' and the scope of this branch as:

- Nursing and healthy upbringing of infants and children.
- Enriching the breast milk and purifying it whenever it is found deficient in quality and quantity.
- Treatment of: 1) Diseases due to the use of vitiated breast milk, 2) Diseases peculiar to children and 3) Diseases due to influence of grahās.

Almost all ancient āyurvedic literature as well as Kaumārabhṛtya texts such as Kāśyapa-samhita describe various samskārās to be performed at different stages of growth and development of an infant as well as an

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individual. Though these samskārās are basically described in details with its religious background in religious books like Grahasūtras, Manusmṛti, etc., āyurvedic paediatricians had mainly adopted them due to their significance in child's growth and development as well as prevention of diseases by means of immunizing the child against a host of diseases that a child may suffer in its later life.

Childhood samskāras

The word 'samskāra' is derived from the root 'kri' with 'sam' upasarga, which denotes different meanings according to the context. In āyurveda it is accepted in a sense of 'guṇāntarādhāna', which means transformation of qualities, refinement, etc. The samskārās are performed at a particular period of ones' life time. There are about 16 common samskārās, though different texts have different numbers. Out of these 16, about 7 samskārās are performed during the childhood period. The jātakarmasamskāra is also a process to immunize a child against diseases of old age (vātaja rogas).

Jātakarmasamskāra

This is the first samskāra to be performed immediately after the birth of a child. It is performed after the child is cried and cutting of the umbilical cord. In a religious way, the father applies a mixture of madhu-ghṛta on the tongue of the child as the first feed in the presence of elders, relatives, priests and paediatrician. There is also a method of administering gold rubbed with madhu-ghṛta, which is called suvarṇa prāśana. The āyurvedic texts confirm the following socio-medical benefits of jātakarma: 1) medhājanana (promotion of intellect), 2) āyuṣya (longevity) and 3) bala (strength/immunity)

With the birth, the child becomes independent from the mother and continues its life on external source of food i.e. breast milk. In order to suck the breasts of mother, the child has to have developed required rooting, sucking and swallowing reflexes. The paediatrician can assess/identify the development of these reflexes while the jātakarmasamskāra is performed.

Now certain questions arise, as to why the ancient physician preferred to administer only madhu-ghṛta? How the madhu and ghṛta to be used i.e. in unequal quantity or equal quantity? Usually, madhu and ghṛta in equal quantity is considered as virudhadravya (antigenic); can we apply this unequal mixture to a new-born child? In a study "Response of the new-born to madhu-ghṛta" conducted by the author, it has been hypothetically agreed that the administration of madhu-ghṛta mixture during jātakarmasamskāra be considered as a process of viruddhābhisamskṛti (immunization), by means of which a child develops ability to withstand the diseases due to vitiation of vāta, which is a rule of nature that happens more in old age.

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SAPTAPARṆA (*ALSTONIA SCHOLARIS*) - A REVIEW

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Abstract: Saptaparṇa (*Alstonia scholaris*) has referred to in many āyurvedic literatures for its pharmacological activities ranging from antimalarial to anticancer activities. The plant is widely distributed in India from sub Himalayan region to West Bengal and South India. The bark, leaves and milky exudates of the plant are used in many āyurvedic formulations. This paper reviews the findings and significance of the properties of saptaparṇa.

Introduction

Saptaparṇa is described as kuṣṭhaghna and udarda praśamana. It has referred to in Kaṣāyaskanda and Tiktaskanda (Carakasamhita) and in many formulations such as Āragwadadi and Lākṣādi.

Common names: - Dita bark, devil tree (English); saitan ka jhar, citvan (Hindi), satvin (Marathi); daivappāla, ezhilampāla (Malayalam), ezilai palai, mukumpalai (Tamil), Chattim (Bengali) and Saptaparṇa (Sanskrit)

Āyurvedic indications: - Dalhaṇa has explained one of its morphological features that the leaves resemble those of śālmalī. Śivadatta has mentioned it as bahuguchha, one that possesses multiple inflorescences. Usage of its decoction in different modes is mentioned to be useful in various conditions (C.S.Ci 7/97-99). It is described that application of its latex in dental caries relives the pain and kills the organisms (A.H.U.22/20). Its decoction is recommended in prameha (S.S. Ci. 11/9).

Pharmacological properties: - Rasa - tikta and kaṣāya; Guṇa - laghu and snigdha; Vipāka - kaṭu; Vīrya - uṣṇa; Karma - tridoṣahara.

Phytochemistry: - Saptaparṇa is known to contain a good number of alkaloids and has proved to be responsible for major therapeutic activities. The plant contains bioactive principles in almost all parts. (Tables 1 & 2)

Some of the empirical findings highlighting the significance of the properties of the plant are detailed under.

Anti-diarrhoeal activity

The anti-diarrhoeal effects of the aqueous and the alcoholic extracts of *A. scholaris* bark in mice have reported by Patil *et al* (1999). In an *in-vivo* study, the crude extract of *A. scholaris* had tested positive for the presence of alkaloids, provided 31-84% protection against castor oil-induced diarrhoea in mice at 100-1000 mg/kg doses, similar to loperamide. These results indicate that the crude extract of *A. scholaris* possesses anti-diarrhoeal and

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spasmolytic effects, mediated possibly through the presence of calcium channel blockade like constituent(s) and this study provides a mechanistic base for its medicinal use in diarrhoea and colic (Shah *et al* 2010).

Hepatoprotective activity

Lin *et al* (1996) has studied the hepato-protective effect of *A. scholaris* on liver injuries induced by carbon tetrachloride (CCl_4), beta-D-galactosamine, acetaminophen and ethanol by means of serum-biochemical and histopathological examinations and the serological and histopathological effects have reported to be indicated that hepatoprotective activity of saptaparṇa was by way of inhibiting cell necrosis and inflammatory cell infiltration.

Immunomodulatory activity

A study on the immune-stimulatory effect of *A. scholaris* bark extracts in BALB/c mouse has reported that the aqueous extract at 50 mg/kg b.w. induced the cellular immune response while at 100 mg/kg b.w. inhibited the delayed type of hypersensitivity reaction (Iwo *et al* 2000).

Anti-microbial activity

In ayurvedic literature, ability of plants to neutralize the toxins (viṣa) liberated by bacterial pathogens has described. Similarly, use of the plant in external application on krimi and in infectious bacterial diseases like kuṣṭha, jvara, kaṇḍū and vraṇa has been mentioned (S.S.Su.38/67). Its antimicrobial property is mentioned as effective in rakta krimi and danta krimi.[1]

Khan *et al* (2003) reports that the crude methanolic extracts of the leaves, stem and the root barks of *A. scholaris* on partitioning yield fractions exhibit improved and broader spectrum of antibacterial activity especially the butanol fraction. Interestingly none of the fractions reported to be active against the fungi tested.

Anti-fertility activity

Gupta *et al* (2002) has assessed the fertility and testicular function in extract fed animals. Analysis on mating tests, sperm motility, sperm concentration, biochemical indices and testicular cell population dynamics were conducted and found significant reduction in seminiferous tubule and Leydig cell nuclear area. Reduced sperm count and motility resulted in a total suppression of fertility. A significant fall in the protein and sialic acid

TABLE 1

Parts of Saptaparna plant having medicinal usage

Part of the plant	Therapeutic utility
1. Bark	Febrifuge, Alterative, Tonic and Gastrointestinal sedative.
2. Milky Juice or latex of bark	Dental caries, pimple, pyorrhea. Applied to ulcers and rheumatic pains. Mixed with oil and dropped into ears, relieves earache.
3. Tender leaves	Roasted, pulverized and made to a poultice which is used as a local stimulant to unhealthy ulcers. snake-bite
4. Leaves	Anti–ulcer, anti-rheumatic, asthma, anti-rheumatic, anti-diabetic
5. Flower	Asthma, respiratory troubles.
6. Root	Enlarged liver with pain.

content of the testes, epididymis, seminal vesicle and ventral prostate as well as glycogen content of testes were also noticed. The study concludes that *A. scholaris* bark extract has a significant antifertility effect in male rats; the primary site of action may be post meiotic germ cells.

A study undertaken to evaluate the antifertility activity of the active principle, i.e. lupeol acetate, isolated from benzene extract of *A. scholaris* in male albino rats reports that the treatment with lupeol acetate did not cause any significant change in the body weights, but significant reduction in the weight of reproductive organs, i.e. testes, epididymis, seminal vesicle and ventral prostate, was observed. Testicular sperm count, epididymal sperm count and motility were found significantly declined when compared with controls, which resulted in reduction of male fertility by 100%. Arrest of spermatogenesis was noted at various stages with production of primary spermatocytes (preleptotene and pachytene), secondary spermatocytes and spermatids. The seminiferous tubules found reduced in size and cross-sectional surface area of Sertoli cells as well as their counts were found to be significantly depleted. Further, Leydig cell nuclear area and number of mature Leydig cells were reported decreased. Biochemical parameters of tissues i.e. protein, sialic acid, glycogen and cholesterol content of testes and seminal vesicular fructose also reported significant reduction (Gutpa *et al*, 2005).

Jagetia and Baliga (2006) hve reported the anticancer effect of various doses of an alkaloid fraction of saptaparna, *in vitro* in cultured human neoplastic cell lines and in Ehrlich ascites carcinoma bearing mice. In contrary to the previous observations Gupta *et al* (2008) has reported the radioprotective efficacy of a hydro-alcoholic extracted material from the bark of *A. scholaris* by way of protection against radiation-induced hematological and biochemical alterations in Swiss albino mice.

Anti-carcinogenic activity

In āyurveda, any abnormal growth of tissue is referred to as gulma which is mainly due to vitiation of tridoṣas. These vitiated doṣas further vitiate the rakta and māmsa dhātus.[2] Saptaparṇa predominantly has tiktarasa which is responsible for dīpana, pācana, lekhana and

TABLE 2
Major phytoconstituent of Saptaparṇa with medicinal activity

Phytoconstituent	Medicinal value
1. Alstonine	Antimalarial activity, Anxiolytic activity, Schizophrenia, Antipsychotic and Anticancer activities.
2. Echitamine chloride	Anticancer activity in S–180, Regression of tumour growth, Fibrosarcoma
3. Villalstonine	Antiamoebic, Antiplasmodial activity against K1 strain of Plasmodium falciparum, *in vitro* anticancer activity against human lung cancer cell lines
4. Lupeol acetate	Antifertility effect on male Wistar rats
5. Scholaricine	-

śoṣaṇa properties, which explains the anticancer action of the drug. Jagetia and Baliga (2006) has reported the anticancer effect of various doses of an alkaloid fraction of saptaparṇa *in vitro* in cultured human neoplastic cell lines and in Ehrlich ascites carcinoma bearing mice. In an investigation to understand the mechanism of anticancer effect of saptaparṇa, Saraswathi *et al* (1999) has reported the effect of Echitamine chloride, an indole alkaloid, extracted from the bark of *A. scholaris* drug on the microsomal drug detoxifying system. In sarcoma 180 bearing mice has the impaired drug detoxifying system as indicated by the decreased levels of drug metabolizing enzymes. The study reveals that the treatment with chitamine chloride corrected to near normal levels of such enzymes and microsomal hemeproteins. In another study earlier Sarswathi *et al* (1998) had reported the mechanisms behind the mode of action of echitamine chloride. The effect of echitamine chloride on the mitochondrial and cellular respiration of S-180 tumor cells were studied, which concluded that echitamine chloride affects both cellular and mitochondrial respiration, leading to reduction of the cellular energy pool and thereby resulting in the loss of viability of tumor cells.

Season plays important role on the composition of the bioactive compounds of the medicinal plants which affects on their pharmacological actions. Jagetia and Baliga (2005) has investigated the effect of seasonal variation on the antineoplastic activity of *A. scholaris*. In order to evaluate the seasonal variation, HeLa cells were treated with different doses of various fractions of *A. scholaris* collected in monsoon, winter and summer. The study demonstrated that the extract prepared from the summer collection, and the fractions containing the alkaloids were highly effective in cell killing. The crude extract of the drug was more powerful than its active principle echitamine.

Saptaparṇa is known to have chemomodulatory activity by enhancing the anti-tumor activity of anticancer drugs. A study conducted (Jagetia and Baliga, 2004) reports that crude extract of *A. scholaris* enhances the anticancer activity of berberine in the Ehrlich ascites carcinoma bearing mice. This modulatory activity varied when tested at various stages of tumorigenesis. In another study Jagetia and Baliga (2003) has reported the modulation of antineoplastic activity of cyclophosphamide by *A. scholaris* in the Ehrlich ascites carcinoma bearing mice. It says combination of drugs in appropriate concentrations caused the highest tumor regression and enhanced the mean survival time and the average survival time similarly a dose-dependent increase in the anticancer activity observed. The report says that best effect was observed, as evidenced by the greater tumor remission, when compared with the concurrent doses of either drug alone; and that administration of saptaparna before the administration of the cyclophosphamide resulted in a drastic decline in the glutathione levels and increased the lipid peroxidation considerably when compared with either drug alone.

Another study, chemo-preventive effect of saptaparṇa in benzo(a)pyrene-induced forestomach carcinogenesis in mice (Jagetia *et al* 2003), has confirmed the *in vivo* findings with the *in vitro* micronucleus assay, where treatment of mice with ASE before, during and

after carcinogen treatment found to be reduced the frequency of micronuclei (MN) in the splenocytes in a dose dependent manner.

Chitamine chloride's antitumor effect on methylcholonthrene induced fibrosarcoma has reported (Kamarajan *et al* (1991). The study reports that altered activities of plasma and liver transaminases and gamma-glutamyl transpeptidase and lipid peroxidation in fibrosarcoma corrected to near normal after echitamine chloride treatment; and that the decreased liver glutathione content and the lowered activities of glutathione peroxidase, superoxide dismutase and catalase reversed to near normal after echitamine chloride treatment.

Recently, Jahan *et al* (2009) has investigated the possible chemopreventive and anti-oxidative properties of this medicinal plant on two-stage process of skin carcinogenesis induced by a single application of 7, 12-dimethyabenz(a)anthrecene (DMBA). The tumor incidence, tumor yield, tumor burden and cumulative number of papillomas were found to be higher in the carcinogen in untreated controls as compared to experimental drug administered animals. Furthermore, a significant increase in reduced glutathione, superoxide dismutase and catalase but decrease in lipid peroxidation was measured in the extract administered experimental groups. The study has reported chemopreventive potential of *Alstonia scholaris* bark extract in DMBA-induced skin tumorigenesis in Swiss albino mice.

Anti-parasitic activity

Gandhi and Vinayak (1990) have investigated the antimalarial activity of saptaparṇa in mice in an early preliminary study. A dose-dependent improvement of conditions and delayed mortality amongst animals that received methanol extract of *A. scholaris* were noticed. Keawpradub *et al* (1999) reports the antiplasmodial activity of extracts and alkolides of *Alstonia* species against multidrug-resistant K1 strain of Plasmodium falciparum cultured in human erythrocytes. The study found that the active alkaloids, in contrast to chloroquine, have significantly higher affinity to the K1 strain than to the T9-96 strain.

Molluscicidal evaluation of aqueous extract of three common plants of *Thevetia peruviana, Alstonia scholaris* and *Euphorbia pulcherrima* against two harmful freshwater snails, *Lymnaea acuminata* and *Indo-planorbis exustus*, has reported by Singh and Singh (2005). It was suggested that these plant extracts may eventually be of great value for the control of harmful aquatic snails and other molluscan pests.

In an effort to compile the mlluscicidal products of biosynthesis, which are potentially biodegradable in nature, Singh *et al* (2010) has assessed some commonly used medicinal plants including saptaparna for potent molluscicidal activity against freshwater snails. The study assembles all the known information on molluscicidal properties of common medicinal plants of eastern Uttar Pradesh, India, which might be useful for the control of harmful snails.

In nighaṇṭūs one of the actions of the drug saptaparṇa has been explained as krimighna owing to its tiktarasa.[3] In classical texts also, drugs that are predominantly having tiktarasa are indicated to have anti-helmintic activity. Mode of action of these drugs has been

explained as due to prakṛti vighāta action. This may be interpreted as changing the gut environment which is not conducive for the survival and growth of the parasitic worms.

Recently, an investigation on anthelmintic activity of the alcoholic extract of *A. scholaris* using *Ascardia galli* has reported glucose uptake, glycogen content, lactic acid production, gross motility and acetylcholine esterase activities of the worms after the incubation. The study reported significant inhibition of glucose uptake and decrease in glycogen content of the worms with *A. scholaris*; and significant increase in lactic acid content and decrease in gross motility. It indicates the extract affects the energy generating mechanism of the parasite. The significant increase in lactic acid content suggests the inhibition of ATP production or accumulation of lactic acid. The extract had significant anthelmintic activity and the possible mechanism of action may be by inhibition of energy metabolism (Arulmozhi *et al* 2007).

Adaptogenic activity

Kulkarni and Juvekar (2009) have reported the effect of stress and its modulation of methanolic extract of bark of *A. scholaris* in acute restraint stress model mice. The extract also evaluated for nootropic and antioxidant potential to support anti-stress activity testing. The study reports that acute restraint stress resulted in significant increase of plasma corticosterone, glucose, protein, cholesterol and triglyceride levels in stress group of animals. The study provides scientific support for anti-stress (adaptogenic), antioxidant and nootropic activities of methanolic extract of bark of *A. scholaris.*

Jagetia and Baliga (2004) have reported the nitric oxide (NO) scavenging activity of the saptaparna; The report says that the NO scavenging activity was dose-dependent and that saptaparna is potent and novel therapeutic agent for scavenging of NO and the regulation of pathological conditions caused by excessive generation of NO and its oxidation product, peroxynitrite.

Radio-protective and radio-sensitivity activity

Gutpa *et al* (2008) has reported the radio-protective efficacy of a hydro-alcoholic extracted material from the bark of *Alstonia scholaris* in mice against radiation-induced hematological and biochemical alterations. The study reports that significantly higher erythrocyte, hematocrit, and hemoglobin values, considerable lower levels of lipid peroxidation and significant increase in glutathione levels in serum as well as in liver were recorded in drug pretreated animals compared to untreated animals.

In another study, Jagetia and Baliga (2003) have reported the radio-sensitizing effect of an alkaloid fraction of *A. scholaris* in various neoplastic cell lines. The study reports that the pretreatment increased the effect of radiation as evidenced by enhanced cell; and that the *in vitro* observations confirmed by *in vivo* studies, where the irradiation of Ehrlich ascites carcinoma bearing mice caused a dose-dependent tumor regression, as evidenced by increased life span of the animals. Further, the report says, that there was a radiation dose-dependent increase in the life span of tumor-bearing animals; and that the findings corroborated with a time-dependent decrease in the glutathione (GSH) contents,

accompanied by an increase in lipid peroxidation.

Broncho-vasodilatory activity

In the classical texts, saptaparṇa is extensively used in śvāsa. In Gadanigraha the property of the drug has been explained as tridoṣaghna indicating the activity to maintain the equilibrium of three doṣas.[4] In samhitas (Ch.Chi18/114; Su Ut. 51/36; A.S.Chi. 6/35) saptaparṇa is indicated along with honey and pippali in pittakaphaja śvāsa. This indicates the broncho-vasodilatory action of the drug but not the branchodilatory action as seen in routinely used śvāsahara drugs. This mechanism of action of saptaparṇa has recently confirmed by the work of Channa *et al* (2005). Ethanolic extract of *A. scholaris* leaves evaluated for induction of pronounced bronchodilatory activity in rats have shown that the bronchodilation action of the drug was not due to the direct tracheal smooth muscle relaxation but mainly was via endothelial-derived relaxing factor, nitric oxide. The study reports that the extract caused marked reduction of barium chloride, potassium chloride and calcium chloride induced contraction on guinea-pig ileum and pulmonary artery, implying a direct interference of plant extract with the influx of calcium ions into cells. The study has revealed that saptaparṇa leaves possess broncho-vasodilatory activity mediated presumably by prostaglandins, calcium antagonism and endothelium-derived relaxing factor(s).

Wound healing activity

Saptapraṇa latex has indicated in healing of dirty wounds (Vrinda Madhava 44/34) as the drug is having kaṣāyarasa. The main function of kaṣāyarasa is vraṇaropaṇa (wound healing property).[5]

Arulmozhi *et al* (2007) has recently investigated the wound healing property of the ethanol and aqueous extracts of *A. scholaris* against excision, incision and dead space wound models. The wound healing was assessed by the rate of wound contraction, period of epithelialisation, skin breaking strength, granulation strength, dry granulation tissue weight, hydroxyproline, collagen and histopathology of granulation tissue. Malondialdehyde level was also estimated to evaluate the extent of lipid peroxidation. The study reports that the extracts promoted wound healing significantly in all the wound models; and that increased rate of wound contraction, skin breaking strength, granulation strength, dry granulation tissue weight, hydroxyproline and collagen, decrease in the period for epithelialisation and increased collagenation in histopathological section observed with extracts treated groups. The extracts also significantly decreased the levels of lipid peroxidation.

Analgesic and anti-inflammatory activities

Saptaparṇa has been indicated in pain by D.N and G.N, though type of pain is not explained in detail. In Aṣṭāṅgahṛdayam (U. 22/20) application of saptaparṇa latex is indicated in pain caused by different dental infections.[6]

Toxicity

There is an indirect reference to the toxicity of saptaparṇa in āyurveda.[7] Dalhaṇa has used the word śarat which could be interpreted as referring to the period of bark collection. This observation was recently confirmed by the research conducted for evaluating the time of collection and pharmacological effect.

Baliga *et al* (2004) has reported the acute and

sub-acute toxic effects of various doses of hydroalcoholic extract of *A. scholaris*. They report that acute toxicity in mice depended on the season of collection of plant was seen and that the highest acute toxicity observed in the extract prepared from the summer collection followed by winter; and that the least toxicity observed in the extract prepared from the bark of *A. scholaris* collected in the monsoon season. It was suggested that the toxic effect of the drug might be due to the presence of echitamine. Further, the study reports that at high doses, *A. scholaris* exhibited marked damage to all the major organs of the body.

It is worthwhile to mention here that Caraka and Śusruta have also recommended the collection of bark from medicinal plants in śarat ṛtu, without specifically mentioning sapta-parṇa.[8]

Jagetia and Baliga (2003) have reported the teratogenic effect of hydroalcoholic extract of *A. scholaris* in the pregnant Swiss albino mice. The study says that a dose dependent increase in the mortality, growth retardation, and congenital malformations, characterized mainly by bent tails and syndactyly observed and that the administration of higher doses of the drug caused significant delay in the morphological parameters such as fur development, eye opening, pinna detachment and vaginal opening. It has also reported that the incisor eruption and testes decent found to be delayed in litters born to the mothers treated with high dose of the drug.

Conclusion

Detailed investigations with ethnopharmacological approach are required for clear understanding of the mechanism of action drugs. The plant saptaparna has a wide array of pharmacological activities and many isolated compounds of plant needs to be studied for their pharmacological activity. Research using modern technological tools is essential to explore the bioactive compounds of medicinal value.

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   हृद्यो दोषक्रिमिश्वासकुष्ठगुल्मव्रणास्रजित्। (का. नि.)
2. शूलगुल्मक्रिमीन् हन्ति कुष्ठं शाल्मलिपत्रकः। (ध. नि.)
   स्निग्धो हृद्यः क्रिमिश्वासकुष्ठगुल्मव्रणास्रजित्। (कै. नि.)
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   मदगन्धो त्रिदोषघ्नः सूलरक्तरुजापहः। (गदनिग्रह)
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8. शरदि त्वक्कन्दक्षीराणि (च. क. १)
   प्रावृट्वर्षाशरद्हेमन्तवसन्तग्रीष्मेषु यथासंख्यं मूत्रपत्रत्वक्क्षीरसारफलान्याददीतेति। (सु. सू. ३७)

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SOMATIC CONSTITUTION (DEHAPRAKṚTI) OF PATIENTS OF ACID PEPTIC DISORDERS (PARIṆĀMAŚŪLA) - AN ANALYSIS

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Abstract: Determination of prakṛti helps in diagnosis, prevention, management and prognosis of a disease. Pariṇāmaśūla (acid peptic disorders) is one of the commonly occurring clinical conditions in medical as well as surgical practice. Today the incidence shows increasing tendency because of food habits and stress related life style. The cardinal feature of pariṇāmaśūla is pain during digestion of food, which torments the person at every meal time. The features may vary according to dominance of doṣa correlating both ulcerative and non-ulcerative acid peptic disease. Here an attempt is made to assess the dehaprakṛti of patients of acid peptic disorders (pariṇāmaśūla).

Material and methods

In this observational clinical study, 20 patients with the signs and symptoms of pariṇāmaśūla were selected from the OPD/IPD of SDM Āyurveda Hospital, Udupi. The patients were categorized according to diseases as per endoscopic and clinical findings; and their prakṛti was assessed on a proforma specially prepared.

Inclusion criteria: - Patients with pratyātma-lakṣaṇa of pariṇāmaśūla irrespective of sex.

Exclusion criteria: - Patients less than 15 and more than 60 years; cases of systemic disorders like tuberculosis, mycardial infarction, HIV and hepatitis; complaints of acute abdomen.

Observation and results

The endoscopy findings were predominantly of chronic atrophic gastritis and duodenal ulcers (Table 1). However, chronic superficial gastritis, reflex oesophigitis, erosive gastritis, chronic atrophic gastritis with hyperplasia and gastric ulcer were presented with pariṇāma-śūlalakṣaṇa.

30% of patients were under the age group of 31-40 years followed by 25% under 51-60 years, 20% under 41-50 years, 15% under 21-30 years and 10% above 60 years; 60% were male and vāta-pitta prakṛti and 40% were female and pitta-kapha prakṛti (Table 2). As per the classics, this comes under madhya-mavaya: wherein, pittajavyādhi are more common. The latter half of this avastha is that of hrāsamānadhātu and this could explain the atrophic changes. In modern parlance too, virtually everybody in developing countries has gastritis by 50 years. The condition occurs more frequently with advancing age, average being 40-45 yrs. Peptic ulcers are more frequent in the middle aged adults.

Predominance of pittadoṣa predispose to occurrence of pitta pradhānavyādhi. The sthāna

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TABLE 1
Incidence of pariṇāmaśūla - Endoscopic findings

	Finding	No. of patient	%
1.	Chronic atrophic gastritis	8	40
2.	Chronic atrophic gastritis with hyperplasia	1	5
3.	Chronic atrophic gastritis with hiatus hernia	1	5
4.	Gastric ulcer	1	5
5.	Duodenal ulcer	3	15
6.	Chronic superficial gastritis	2	10
7.	Reflex oesophigitis	2	10
8.	Erosive gastritis	2	10

TABLE 2
Distribution of patients according to age, sex, etc.

	Description	No. of patient	%
1.	Age (in yrs.)		
	- < 20	0	0
	- 21-30	3	15
	- 31-40	6	30
	- 41-50	4	20
	- 51-60	5	25
	- >60	2	10
2.	Sex		
	- Male	12	60
	- Female	8	40
3.	Prakṛti		
	- Vāta-pitta	12	60
	- Pitta-kaphala	8	40
	- Vāta-kaphala	0	0

of pariṇāmaśūla being grahaṇi, the main doṣa involved are pācakapitta, samānavāta and kḷedakakapha.[3] The vitiation of any one of these causes agniduṣṭi (pācakapitta). Samānavāta disturbances may be in the form of hampered muñcana (movement) leading to stasis of āhāra and thereby śuktapāka (sourness) and āmotpatti; impaired sandhukṣaṇa of agni leading to agnimāndya. Derangement of pācakapitta results in impaired pācana of āhāra leading to āmotpatti.

Conclusion

Maximum number of patients indicates that pariṇāmaśūla predispose to pittapradhāna prakṛti and that it occurs in the middle stage of life where pitta is predominant. Hence it may be concluded that pitta is mostly responsible for the precipitation of the disease acid peptic disorders.

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ANTI-BACTERIAL ACTIVITY OF MṚTYUÑJAYARASA

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Abstract: Mṛtyuñjayarasa is used in the management of various disorders like ajīrṇa (indigestion), āntarika jvara (enteric fever), āmavāta (rheumatoid arthritis), etc. The antibacterial activity of Mṛtyuñjayarasa was tested against pathogenic bacterial strain *Streptococcus pyogenes*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli* and *Salmonella typhi* by *in vitro* well diffusion method at different concentrations. The control solution was prepared by streptomycin.

Introduction

Infectious diseases are posing problem for human beings. Production and use of antibiotics are on rise, which are mostly derived from microbial sources in synthetic manner. All synthetic antimicrobial agents are local irritants and are responsible for hypersensitivity reactions. Another important thing, the widespread misuse of antimicrobials is responsible for emerging microbial resistance.

Development of bacterial resistance and adverse effects of antibiotics has necessitated the search for new antibacterial agents in different systems of medicine.

A number of āyurvedic preparations are being used in cases of infections and have found to be effective. To make the treatment scientifically more validated, assessment of the antimicrobial activity of such preparations by *in vitro* (i.e. culture and sensitivity tests) is necessary.

Mṛtyuñjayarasa is one of the drug compounds mentioned in āyurvedic texts in the management of ajīrṇa (indigestion), āntarikajvara (enteric fever), āmavāta (rheumatoid arthritis), yakṛtplīhāvikṛti (hepato-splenomegaly), rājayakṣma (phthisis), udararoga (abdominal disorders), pakṣāghāta (paralysis) and generally in all types of jvara (fevers).

The formulation Mṛtyuñjayarasa described in Yogaratnākara was selected for the study. It contains hiṅguḷa (Cinnabar), marica (*Piper nigrum*), pippli (*Piper longum*), taṅkaṇa (Borax), vatsanābha (*Aconitum napellus*) and gandhaka (Sulphur).

Aim and objective:- To evaluate the anti-bacterial activity of Mṛtyuñjayarasa against common pathogenic bacteria.

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Materials and method

The antibacterial study was done at Chemind Diagnosis and biosolution, Jaipur. Three different concentration solutions i.e. 50, 100, 125 (1mg/ml) were prepared by sample of Mṛtyuñjayarasa with solvent dimethyl sulfoxide (DMSO). To correlate the result control solution was also prepared by streptomycin in same concentration in same solution.

Chemicals: - All chemicals used for the preparation of nutrient media and for present study were of analytical grade.

Glass-wares and poly-wares:- All the glassware were of sterilizable type and polywares disposable type.

Micro-organisms: - Micro-organisms selected were those which cause general infections along with fever. The pathogenic strains of different species of bacteria used for study were maintained on the media as mentioned in Table 1.

Culture media: - Like all other living forms, micro-organisms also need suitable nutrients and favorable environments for growth. A simple way to obtain bacteria is to grow them in a test tube or a small flask in broth medium. Different growth medias used for micro-organisms as per IMTECH are shown in Table 2.

TABLE 1
Species of bacteria and media used for the study

Species	MTCC No.	Media used
Streptococcus pyogenes	1928	Blood agar
Staphylococcus aureus	3160	Nutrient agar
Escherichia coli	1652	Nutrient agar
Pseudomonas aeruginosa	647	Nutrient agar
Salmonella typhi	734	Nutrient agar

Agar: - Agar is a complex, long chain, polysaccharide derived from certain marine algae and has several useful properties. When added to a solution it melts at 100^0C forming a slightly viscous liquid that solidifies at 42^0C. After solidification the agar would not melt unless the temperature is again raised to 100^0C. This is a useful property. Some other useful properties of agar include its resistance to microbial degradation and its translucence for easy viewing of colonies embedded in the agar.

If a solid medium is necessary, agar is usually added as the solidifying agent. For plates or slants, 2.0% concentration of agar is needed.

Preparation of media

Nutrient broth (13 gms/1000 ml of distilled

TABLE 2
Different growth medias for micro-organisms directed by IMTECH

Media	Unit
1. Nutrient agar	
- Beef extract	1.0 gm
- Yeast extract	2.0 gm
- Peptone	5.0 gm
- NaCl	5.0 gm
- Agar	15.0 gm
- Distilled water	1.0 L
2. Nutrient broth	
- Peptic digests of animal tissue	5.0 g
- Sodium chloride	5.0 g
- Beef extract	1.5 g/L
- Yeast extract	1.5 g/L
3. Blood agar	
- Protease peptone	15.0 gm
- Liver extract	2.5 gm
- Yeast extract	5.0 gm
- NaCl	5.0 gm
- Agar	15.0 gm
- Distilled water	1.0 L

water) was dissolved in distilled water in a conical flask; then, nutrient agar (28gms/ 1000ml of distilled water) was also added and dissolved in a conical flask having nutrient broth. In another flask containing distilled water, blood agar base (21.25 gm/500 ml of distilled water) was dissolved.

Both flasks were then plugged with cotton and autoclaved for complete sterilization. On cooling, media containing agar solidify at about 42ºC. So, after autoclaving, both the flasks were cooled to 45 to 47ºC. Then, sterile human blood (7%) was added in a flask containing blood agar base aseptically.

Preparation of media plates

- Sterilization of culture media was done by autoclaving at 15 lbs pressure for 20 minutes; then the media taken out and kept on a bench for a while and poured into glass petridishes, in laminar flow cabinet.
- Petridish (diameter = 90 mm. lid) has shallow rim. Base is smaller and deeper; base section should be labeled with details of medium, date, etc.
- About 30 ml. of media to be poured into each petridish, if too little agar is poured there may not be enough to cover the dish or the agar plate will dry up easily. If too much is poured, the cover dish will come in contact with the nutrient agar, leaving no room for microbial growth. The plates are rendered useless either way.
- The plates were left undisturbed until the agar solidified. Then the plates were kept at room temperature for overnight for observation of contamination.
- If contamination was there, the plates were discarded. If not contaminated, these plates were wrapped in a foil and kept in cold room at 4^0C for further use.
- The media and media plates were prepared time to time as per requirement and used for antibacterial evaluation.

Evaluation of antimicrobial study was carried out on solid media. On solid media it was done by Well diffusion method.

Well diffusion method

In this method 100 µl of test bacterial subculture was prepared in sterile broth medium (100µl sterile broth medium TOOK in an eppendrof tube; few colonies of microbial culture left inside tube.)

Before long, the prepared medium was spread on media plates. It was allowed to dry for 30 minutes and then 2 holes (each 0.3cm diameter) was made in each media plates using a sterile borer in suitable distance. Total 15 media plates were prepared.

In each media plate, one hole was filled by sample drug solution and one hole by same concentration solution of streptomycin (standard or control). The samples and the control (0.1ml) were placed in 0.3cm diameter well. The plates were incubated at 37°C for 24 hours and after then diameter of the inhibition zone was measured.

Observation and results

On comparison of standard solution, the following observations were made. *Streptococcus pyogenes* was highly sensitive to 12.5% concentration solution of Mṛtyunjayarasa and moderately sensitive to 10.0% concentration. *E. coli, Staphylococcus aureus, Pseudomonas aeruginosa* and

Salmonella typhi found to be moderately sensitive to all concentration of Mṛtyuñjaya rasa. No sensitivity was observed at 5.0% concentration of Mṛtyuñjayarasa against *Streptococcus pyogenes*. The findings corroborate that Mṛtyuñjayarasa is highly effective against *Streptococcus pyogenes* and less effective for other microbes. (Tables 3 & 4)

Conclusion

Mṛtyuñjayarasa inhibits different microbes. The encouraging results obtained from antimicrobial study of Mṛtyuñjayarasa were purely based on *in vitro* experimental methods.

TABLE 3
Antibacterial activity of Mrityunjaya rasa and Straptomtcin on different bacterial strains

Name of bacteria	Zone of inhibition (cm.) in diff. concentration (mg/ml)		
	50	100	125
1. Mṛtyuñjaya rasa			
- *Streptococcus pyogenes*	0	0.38	1.51
- *Staphylococcus aureus*	0.32	0.48	0.85
- *Pseudomonas aeruginosa*	0.35	0.47	0.8
- *Escherichia coli*	0.42	0.5	0.8
- *Salmonella typhi*	0.34	0.55	0.85
2. Straptomtcin			
- *Streptococcus pyogenes*	0.4	0.7	1.1
- *Staphylococcus aureus*	0.4	0.7	0.98
- *Pseudomonas aeruginosa*	0.45	0.68	1
- *Escherichia coli*	0.6	0.95	1.1
- *Salmonella typhi*	0.5	0.85	1

TABLE 4
Relation between zone of inhibition drug sensitivity

Inhibition Zone (I.Z.)	Drug sensitivity
1. No inhibition zone	Insensitive
2. Drug I.Z. << Standard I.Z.	Moderate sensitive
3. Drug I.Z. < Standard I.Z.	Highly sensitive

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ETIOLOGY OF VANDHYATVA WITH SPECIAL REFERENCE TO MALE INFERTILITY - A CRITICAL ANALYSIS

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Abstract: - Infertility will be the major condition that mankind will be facing in the near future. The exact cause of male infertility is still obscure even in modern era of scientific advancements. The references to nidāna of infertility are scattered in āyurvedic texts. This article is an attempt to extract and classify various nidāna mentioned in different contexts and also to bring out some unnoticed points in the basic classifications of vyādhi (direct and indirect references) as well as to compare and correlate these causes in the light of modern science.

Introduction

Until recent times a misconception prevailed that inability to produce progeny was entirely the fault of female partner. On the same hand only women tend to seek gynecological care while men are often reluctant to seek advice. In the past few decades modern science made significant breakthroughs in the field of understanding about many concepts. As the science advances newer etiological factors are being introduced like radiations, occupational and dietary factors.

Āyurveda considers śarīra is formed predominantly by doṣa, dhāthu and mala.[1a] Hence, it is understood that every single micro and macro structure in the body is also formed by the same. Derangement in any of these three components (or together), leads to lakṣaṇa-utpatti, doṣavaiṣamyam, dhātuvaiṣamyam and and malasañcayam.

Āyurveda literature gives ample amount of information on causes and pathogenesis of male infertility from different angles. The word śukra implies dhātu responsible for reproduction.[2a] The śukravahasrotas[3a] (mūlam - vṛṣaṇosepham), it's duṣṭalakṣaṇa[3b] (kḷaibya, aharṣaṇa, kḷībam prajāyate), vidhalakṣaṇa[1b] (kḷībata, cirātpraseka, raktaśukrata), as well as śrotoduṣṭikāraṇas[3c] are explained in treatise. There are various terminologies like vandhyatva, sandhatva, napumsakatva, kḷaibya, kṣīṇaśukra, śukrakṣaya, śukraduṣṭi, śukravṛdhi and their types are explained in detail with causes. Four types of kḷaibya are mentioned in Caraka viz. bījopaghāta, dhvajabhaṅgaja, jarāja, śukrakṣayaja[3d] (which is analogous to seminal diminution, non-erectile phallus, andropause, excess diminution of semen respectively) with their etiology, subtypes, symptoms and treatment. Different napumsakas mentioned

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includes dvireta, pavanendriya, samskāravāhi, vakri, īrṣyabhīrati, vātikasandaka, āsekya, saugandhika, kumbhīka, īrṣyakya and ṣaṇḍa (naraṣaṇḍa), samskāravāhi and vakradhvaj.[3e&1c] While assessing the features of these types they can be classified again into disorders of sexual development and sexual behaviors either of them can lead to male infertility.

Classification

Vyādhi is generally classified as sāmānyaja and nānātmajavyādhis. While analyzing these classifications it is understood that the cause which lead to infertility is incorporated under tridoṣa. E.g.:-

- Under vātajananātmanavikāra, Caraka has explained - vṛṣṇakṣepa and śephastambha, vaṅkṣaṇa ānāha.[3f] Kāśyapa added vandhyatva to it.[4] Śārṅgangdhara explained retonāśa śukrakārśya, śukrasyātipravṛtti.[5a]
- Under pitta - meḍhrapāka and alpaśukrata are mentioned.[3g&5b]
- Under kapha - atisthaulyam, malādhikyam and dhamanīpraticaya are elucidated.[3h]

The above can be sub-classified into avayavaduṣṭi, śukraduṣṭi and śrotoduṣṭi. From the above references it is inferred that any of the three doṣas (or all together) can lead to infertility, either directly leading to śukrakṣaya, vandhyatva, etc. or causing diseases leading to secondary infertility like sthaulya/obesity (one of the aṣṭadoṣa of sthūla is kṛchravyavāyata[3i]). Diseases affecting the sexual organs are also to be considered as they are the mūla of śukravahasrotas.

In this context śrotoduṣṭi prakara[3j] can be interpreted in following manner:-

- Saṅga - Malādhikya, dhamanīpraticaya, śukrāśmari[6a] lead to saṅga in śrotas - e.g. Plaque formation, torsion, hypertension and atherosclerotic changes in arteries can be considered in this regard.
- Vimārgagamana - e.g. Retrograde ejaculation, śukrameha.[3k]
- Atipravṛtti - e.g. Premature ejaculation, atipravṛtti (apānāvṛtavyāna)[3l] lead to kṣaya.
- Siragrandhi - e.g. Phalakośavṛdhi,[1d] varicocele.

Both śukrakṣaya (kḷaibya, cirat niṣekena)[6b] and śukravṛdhi (śukḷāśmari),[6a] contribute as causative factors for male infertility.

Another classification is avastha of vyādhi like dhātugatāvastha - gambhīrāvastha and uthānāvastha. From this classification the understanding of the dhātus involved or how deep rooted the disease is assessed. Either it leads to acute tragic result in the form of death as in case of viṣamajvara while in some other conditions like kuṣṭha and prameha - it leads to chronicity and the chance for transmission of disease genetically becomes high. So in two ways this concept can be analyzed as:

Diseases which have the capacity to reach śukradhātu can cause śukraduṣṭi, śukrakṣaya leading to infertility.

Diseases in śukra level will definitely lead to bījaduṣṭi resulting in: a) causative disease become hereditary, b) child will be born with some abnormalities (if napumsaka/ṣaṇḍa is born - again leading to infertility in next generation).

Another is saptavidha classification (Table 1).[6c] All diseases will come under this classification.

Causative factors

In the context of hereditary factor, the following points can be considered

TABLE 1
Saptavidha classification of vyādhi

	Type	Sub-type
1	Sahaja	Pitṛja, mātṛja
2	Garbhaja	Annarasaja, Dauhṛdavimānaja
3	Jātaja	Santarpaṇaja, apatarpaṇaja
4	Pīḍaja	Sārīrika, mānasika
5	Kālaja	Vyāpannaja, asamrakṣaṇaja
6	Prabhāvaja	Jvaradaya, pisācādaya
7	Svabhāvaja	Kālaja, akālaja

1. The origin of organs from the maternal and paternal parts. The ṣaḍbhāvas of garbha that are mentioned like mātṛja, pitṛja, sātmyaja, satvaja, rasaja and āmaja.[3m] So if there is any defect in any of these factors it forms some anomalies in the child's organs - predisposing khavaiguṇyata.
2. Dūṣitabīja and bījāvayava[3n] - Bījāvayavaduṣti by prakupitadoṣas leads to corresponding śarīrāvayavaduṣti.

- Pūtipraja - delivers only dead fetus or deformed or underdeveloped limbs and organs
- Varta - bisexual child with more feminine characters
- Tṛṇaputrika - bisexual child with more male characters
- Vandhya - part of bīja responsible for śukra production is vitiated.[3o]

Along with sahajavyādhi the garbhajavyādhi of diseases occurs due to improper āhāra and vihāra of mother during pregnancy or by not fulfilling the desires during pregnancy. A summary of etiological factors of vandhyatva is shown in Tables 2 & 3.

Chromosomal anomalies and congenital anomalies explained in the modern science in this regard can be correlated like - Klinefelter's syndrome, undescended testes, malformations of sperm ducts, hypospadias, cystic fibrosis, Kallmann's syndrome, Young's syndrome and Kartagener syndrome.

Some diseases which are mentioned with sahaja variety includes - prameha (kulaja, sahaja – asādhyatva), kuṣṭha, arśas, madātyaya, sthaulya, napumsaka/ṣaṇḍa (according to Śusruta, kḷaibya is due to sahajakāraṇam)[1e] and all these diseases are associated with infertility.

Diseases are also classified as santarpaṇa and apatarpaṇajanya vyādhis. In the present context, kḷaibya is mentioned as santarpaṇajanyavyādhi[3p] while śukrakṣaya is mentioned as apatarpaṇajanyavyādhi[3q]; ultimately, both these lead to infertility and the cause as well as the treatment is also entirely opposite. It shows that nutrition in excess or under the normal requirement gradually leads to infertility. Also many of the metabolic syndromes like obesity, diabetes, hyperlipidemia, hypertension, etc. are proved to cause infertility as per modern science. Deficiency of zinc, Vitamin C, malnourishment, anemia, celiac disease, TB, etc. can be easily correlated and understood on āyurvedic lines. But these should be analyzed properly based on the nutrition (āhāra and sevanavidhi). Similarly, an analysis on harītaki is self-explanatory for its śukrakṣayakāraka[5c] as well as its use in kḷaibyacikitsa.[3r]

Other points may be considered under pīḍaja variety. Śārīrika vyādhis can have a great influence as cause for infertility; chronic diseases like rājayakṣma, vātarakta, etc. (as most of such diseases are progressive) will have a stage of dhātukṣaya which may deplete the śukradhātu too. In diseases like pakṣāghāta person may not have ability to copulate. Other disease conditions to be included are śḷeṣmaja-

arśa (kḷaibya),[7a] pittaja-prameha (muṣkava-dhāraṇam)[2b], medoroga (alpa maithuna),[7b] kaphaja-grahaṇi (strīṣu āharṣaṇam),[3s] halīmaka (strīṣu āharṣaṇam)[3t], śukradhātugata jvara (ṣepha stambha, stabda)[1f], liṅgarśa (upahati pumstvam),[1g] upadamśa (viṣīrṇa liṅgam, muṣkāvarodham),[1h] and śoṣa (śukrakṣayam).[3u] Diseases from modern science to be considered are mumps, tuberculosis, brucellosis, gonorrhea, chlamydia, typhoid, malaria, influenza, smallpox, orchitis, prostatitis and syphilis. Mental disorders will definitely have a greater impact as the desire for sex may be lost in most cases. There are direct references for mānasikabhāvas like soka, cinta, bhaya, trāsa, kḷama, krodha, īrṣya, utkaṇṭha, mada, udvega, etc. as the causative factors.[3v] Saṅkalpa (smaraṇa, sparśana, darśana, śravaṇa)[3w] ceṣṭa, niṣpīḍana - all the 3 are required for attaining proper erection and ejaculation. If indriyas are weak as in indriya-abhighāta or ati/mithya/hīna yoga of indriyas, the first stage of maithuna - saṅkalpa itself is not achieved. Also the anavasthita cittatvam or anavasthita mana can again add to this trouble. Seasons also play an important role, e.g. it is directed not to indulge in excessive sex during grīṣma.[2c] The health status of humans are low in warm climate. Hence, sexual acts are best to be avoided. Śukra is somātmakam and heat is not favorable hence its production in gonads is kept away from the body and high temperature to avoid śukrakṣaya. Prolonged use of laptops, wearing tight undergarments,

TABLE 2
Summary of etiological factors

Group of cause	Individual cause
1 Āhāra, pāna, auṣadha - janya	Śīta, rūkṣa, alpa, kḷiṣṭa, guru, amḷa, lavaṇa, kṣāra, kaṭu, tikta, virudha, ajīrṇāhāra, anaśana, asātmya, atyambupāna, viṣamāsana, piṣṭānna, dadhi, khīra, ānūpamāmsa, kulatha, marica, yavāni, pārasīkayavāni, dhānyaka, śatapuṣpa, caṇaka, harītaki,
2 Vihāraja	Strīṇāmatisevanāt, śrama, kanyāgamana, ayonīgamana, dhīrgharogīgamana, rajasvalogamanam, durgandhayonī gamanam, duṣṭayonīgamanam, pariśṛtayonī gamanam, catuṣpādābhigamanam, adhāvana, śūkānāmatisevanat, śukravegadhāraṇam, vṛṣyāṇāmasevana, akālayoni gamanam, mārutātāpasevana,
3 Mānasika	Śoka, cinta, bhaya, trāsa, kḷama, krodha, īrṣya, utkaṇṭha, mada, udvega,
4 Āgantuja	Ābhicāra, aviśrambhāt, abhighāta, śastradantanakhakṣatāt, kāṣṭaprahara, marmāghāta (viṭapa), dūṣīviṣa, bhūtopagāta.
5 Anya	Rasādīnāmkṣayāt, doṣavaiṣamya, nārīṇāmarasajnatvat, pañcakarmāpacara, śukra mala ṣonitātipravṛtti, vyādhikarṣaṇa, śukradhātugata jvara, śukrameha, liṅgārśa, upadamśa, vyavāyaśoṣa, rājayakṣma, sthaulya, pāṇḍu, majjakṣaya, kaphajagrahaṇi, halīmaka, sahajārśa, jaṭharāgni and dhātvāgnimāndya, śukragatavāta, śukrāvṛtavāta, bahudoṣāvastha, rasapradoṣaja, pāpakarma, bījaduṣṭi.

working near hot furnaces and X rays, regular use of hot tubs, prolonged bicycling can be considered as causes for heat stress. On the contrary, it is advised to indulge in more sexual activities to protect the body from cold climate. If proper ṛtucarya is not followed (śodhanādikarma) it further leads to malasañcaya.

Similarly, śukravahasrotoduṣṭikāraṇas like akālayonīgamana, nigrahat, atimaithunāt, śastrakṣārāgni,[3x] improper postures for sex may lead to failure of delivering semen to proper location. Improper timing for sex due to lack of knowledge may also leads to failure of fertilization. Vegadhāraṇa that leads to śūla and vibandha in the vṛṣaṇa, obstructs proper

TABLE 2
Summary of etiological factors in modern science

Type of cause	Causes
1 Genetic and congenital	Anatomical anomalies like undescended testes, malformations of sperm ducts, hypospadias, Klinefelter's syndrome, cystic fibrosis, Kallmann's syndrome, Young's syndrome, Kartagener syndrome
2 Environmental	Exposure to toxins – pesticides, lead, paint, mercury, benzene, toluene, xylene, boron, heavy metal poisoning, heat, radiations,
3 Nutritional	Malnutrition, anemia, Vitamin C and zinc deficiency,
4 Infection	Mumps, tuberculosis, brucellosis, gonorrhea, chlamydia, typhoid, malaria, influenza, smallpox, orchitis, prostatitis and syphilis
5 Behavioral	Frequent - Smoking, recreational drugs, alcohol, tobacco, anabolic steroids, intense exercise, wearing tight undergarments, hot tubs, 'lap'tops, prolonged bicycling, too frequent copulations or compulsive masturbation.
6 Psychological	Excess stress, performance anxiety, guilt, low self-esteem, depression, relationship conflict, loss of attraction, sexual inhibition, conflicts over sexual preference, sexual abuse in childhood, and fear of pregnancy or sexually transmitted disease
7 Iatrogenic	Steroids, surgery of bladder, prostate or urethra, vasectomy or reversal surgery, side effects of frequently prescribed medications (i.e. Prozac and other SSRIs, Propecia, antihypertensive agents, the thiazide diuretics and beta blockers, Calcium channel blockers and angiotensin converting-enzyme inhibitors), testosterone replacement therapy, antifungal, some ulcer drugs, cancer medications.
8 Hormonal	Deficiency of GnRH , LH, FSH, hyperprolactinemia, hypothyroidism, adrenal hyperplasia, hypogonadotropic hypopituitarism, panhypopitiutarism,
9 Trauma	Spinal injuries
10 Other	Varicocoele, hydrocele, torsion, retrograde ejaculation, premature ejaculation, ejaculatory incompetence, erectile dysfunction, painful intercourse, celiac disease, obesity, diabetes, high blood pressure, heart and vascular disease, multiple sclerosis, venous leak, and the Anti-sperm antibodies, tumors, use of lubricants with spermicidal action, diseases affecting nervous system,

secretion of śukra, lead to excess loss of śukra leading to pratiloma dhātukṣaya. Injuries to the srotas by sharp instruments will lead to infertility. Excess temperature in and around the genital area leads to be decreased spermatogenesis. Abhighāta [śastra/danta/nakhakṣata, kāṣṭaprahara, marmāghāta (viṭapa) factor] is very important as vṛṣaṇa is considered to be very soft and delicate. Classics advise to protect it like eyes while performing svedana karma. Under the cause as kṣāra and dūṣīviṣa,[1i] it includes usage of many artificial chemicals and salts used for food flavoring, chemicals, chemotherapeutic agents, etc. which will have spermicidal action. As śukra is having similar guṇas as ojas and contradictory to guṇas of viṣa, all type of viṣas, heavy metals including lead, mercury, etc. becomes etiological factors.

Among rasas kaṭu, lavaṇa, amḷa, āgneya guṇapradhāna āhāra leads to śukrapāka and śoṣaṇa, kaṣāya rasa is very much stambhana leading to śukrarodha by stambhana. Tiktarasa in excess due to its rūkṣata can lead to kṣapaṇa, śoṣaṇa of śukra. Madhurarasa is beneficial, but in excess, can lead to śrotorodha by abhiṣyanda and picchila guṇa (also santarpaṇa leading to kḷaibya). Also, various food items like piṣṭānna, dadhi, khīra, ānupamāmsa, kulatha, marica, yavāni, pārasīkayavāni, dhānyaka, śatapuṣpa, caṇaka and harītaki are said to have śukrahara or kḷaibya kāraka action.

Last but not the least, 'daiva',[3y] as a factor, is to be considered. It can be also included under karma or prañjāparādha, deeds of the past or the present life of the patient or his ancestors/kinships. All the idiopathic causes as mentioned in the modern science can also be considered here.

Conclusion

Even amṛta (ambrosia), if used in excess, can act as viṣa and viṣa itself if given after proper śodhana in right dose acts as auṣadha. It is up to the wise physician to decide if the patient needs śukra-janana/stambhaka/śodhaka/pravarttaka or other samprāpti vighaṭaka dravyas. Similarly, etiology mentioned and discussed above has to be thoroughly investigated and assessed in each and every patients presenting with vandhyatva with special reference to male infertility; to aid in very specific diagnosis and initiate primary limb of treatment nidāna parivarjana to get apt results.

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