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REVIEW ARTICLE

A Comprehensive Review of *Usakadi* and *Veetarvadi Gana*: Ayurvedic Insights into Managing Urinary Tract Infections and Renal Calculi

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Abstract

Background. Urinary tract infection (UTI) and urinary calculi (*Ashmari*) differ in causation — infective versus physicochemical yet overlap clinically and frequently coexist, so management depends on accurate diagnosis. Classical Ayurvedic compendia do not recognise these modern categories, but they group drugs into therapeutic groups (*Gana*) of shared pharmacodynamic character, and the *Susruta Samhita* preserves an early systematic attempt at such grouping. Objective. To review critically the classical description and therapeutic significance of *Usakadi Gana* and *Viratarvadi Gana* and to assess their possible conceptual and pharmacological relevance to urinary tract infection and renal calculi. Methods. The primary source was examined in a published English translation of the *Susruta Samhita*, with group composition, indications and botanical identities cross-checked against *Dravyaguṇa* literature, pharmacognosy sources and contemporary urology and microbiology guidelines; evidence was stratified as classical textual, pharmacognostic, in vitro, animal, human observational or clinical trial. Results. Verification placed the composition of both groups in *Sutrasthana 38 (Dravyasaṅgrahaṇīya-Adhyaya)*, not in *Sutrasthana 37 (Misraka-Adhyaya)*, which concerns drugs used in inflammatory swelling. Both groups are indicated in *Ashmari*, *Sarkara*, *Mutrakṛcchra* and *Mutraghata*; *Usakadi Gana* comprises seven mineral and saline substances and *Viratarvadi Gana* is a larger plant-based group. Contemporary reports on their constituents describe mainly in vitro antimicrobial, diuretic and crystallisation-inhibiting effects, with a small animal literature and no controlled human evidence for the groups as complete formulations. Conclusion. These *Gana* merit systematic investigation, but equivalence between classical concepts and modern diagnoses, and between laboratory activity and clinical efficacy, cannot be assumed.

Keywords: *Usakadi Gana*; *Viratarvadi Gana*; *Susruta Samhita*; *Ashmari*; urinary tract infection; renal calculi; *Dravyaguṇa*; urolithiasis

Introduction

Urinary tract infection and urinary stone disease both present with dysuria, loin or suprapubic pain and lower urinary symptoms, but their causes and treatments differ. Accurate diagnosis therefore determines management, and misdirection is costly: an unrecognised obstructed infected system can progress to pyonephrosis or urosepsis, while indiscriminate antimicrobial use drives resistance, which the World Health Organization reports now affects roughly one in six laboratory-confirmed bacterial infections worldwide.^{1,2,3}

Ayurvedic literature approaches the same territory differently. Disease is characterised by disturbed function of *Doṣa*, *Dhatu* and *Srotas*, and therapy is chosen by the pharmacodynamic properties of drugs. Urinary disorders are discussed across the *Bṛhatrayi*, and *Sushruta*, whose work is weighted towards structural disease — gives particular attention to urinary calculus

(*Ashmari*). Classical compendia group drugs into *Gana*: sets of substances sharing taste (*Rasa*), quality (*Guna*), potency (*Virya*), post-digestive effect (*Vipaka*) and action (*Karma*), and therefore interchangeable within an indication. The *Sutrasthana* preserves some thirty-seven such groups, each named after its first member; *Usakadi Gana* and *Viratarvadi Gana* are two of them.^{4,5}

This review does not assert that Ayurveda described UTI or renal calculi as modern medicine defines them. Modern categories rest on microbiology, crystallography and imaging; Ayurvedic categories on inferred disturbances of function expressed through *Srotas* and *Doṣa*. What can be examined is whether the classical indications of these groups overlap conceptually with modern urinary conditions, and whether their drugs have measurable properties relevant to those conditions.

The Classical Foundation: *Sutrasthana 37* and *38*
Verification against the text and its published translation

does not support the premise that these groups are described in *Sutrasthana 37 (Misraka-adhyaya)*, and the correction is material. *Sutrasthana 37* is the miscellaneous chapter. Its subject is the eight procedures applied to inflammatory swelling (*Vraṇa Sopha*) — softening, ripening, bursting, squeezing, cleansing, healing, promoting granulation and reducing excess tissue — with the pastes, decoctions, wicks, ghee, oils, powders and fumigants appropriate to each. Its drugs are assembled by procedural purpose, and neither group appears within it.⁶

Both are recorded in *Sutrasthana 38*, the *Dravyasangrahaṇīya-Adhyaya*, where the therapeutic groups are enumerated with their constituents and indications. The chapter closes: “Thus ends the thirty-eighth Chapter of the *Sutrasthana* in the *Sushruta Samhita*, which deals with the classification of drugs according to their therapeutical use.”⁴ Reviews citing *Sutrasthana 37* for these *Gana* are, on the evidence examined here, misattributing a chapter number; several cite the thirty-eighth correctly elsewhere in their own reference lists.^{5,7}

Composition of the Two *Gana*

Uṣakadi Gana comprises *Uṣaka*, *Saindhava*, *Silajatu*, the two *Kasisa*, *Hingu* and *Tuṭṭhaka* — seven substances.⁴ This is not a plant group. *Uṣaka* is an alkaline earth, *Saindhava* rock salt, *Silajatu* a bituminous mineral exudate, the two *Kasisa* metallic sulphates, *Hingu* the oleo-gum-resin of asafoetida, and *Tuṭṭhaka* a copper sulphate; the only botanical member is *Hingu*. The group is best read as salts, alkalis and minerals sharing a desiccating, kapha-reducing profile. Its stated indications are mitigation of kapha, drying of fat, and relief of calculus and gravel, dysuria and abdominal tumours.^{4,8,9}

Viratarvadi Gana is a larger plant-based group: *Virataru*, the two *Sahacara*, *Darbha*, *Vṛkṣadani*, *Gundra*, *Mala*, *Kusa*, *Kasa*, *Asmabhedaka*, *Agnimantha*, *Morata*, *Vasuka*, *Vasira*, *Bhalluka*, *Kuruntaka*, *Indivara*, *Kapotavaṅka* and *Svadamṣṭra*.⁴ Counted membership varies with how compound items such as “the two *Sahachara*” are treated — seventeen or eighteen entries — a genuine textual variation rather than error in any single source. Its indications are *Vata*-predominant disorders, calculus and gravel, dysuria, and the pain of

urinary retention.^{4,7,9}

Botanical Identification of the Constituent Drugs

Several grasses have stable identifications: *Kusa* is *Desmostachya bipinnata* (L.) Stapf, *Kasa Saccharum spontaneum* L. and *Darbha Imperata cylindrica* (L.) P. Beauv., all Poaceae.^{10,11} Others are contested. *Sahachara* is recorded as both *Barleria prionitis* L. (Acanthaceae) and *Strobilanthes ciliatus* Nees, used interchangeably in the market.¹² *Virataru* is variously given as *Dichrostachys cinerea* (L.) Wight & Arn. (Fabaceae), so its identity remains provisional.¹³ *Agnimantha* is conventionally *Premna* species - the *Dashamula* identity — though *Clerodendrum* is recorded as *Tarkari* and is not interchangeable.¹⁴ *Kapotavaṅka* is given as *Dalbergia lanceolaria* L.f., with *Suvarcla* offered as an equivalent in some clinical readings.^{8,15}

Vashuka is glossed as *Apamarga*, *Achyranthes aspera* L. (Amaranthaceae), and *Bhalluka* as *Syonaka*, *Oroxylum indicum* (L.) Benth. ex-Kurz (Bignoniaceae). *Ashmabhedaka* carries the transparent meaning of stone-breaking and is frequently equated with *Paṣaṇābheda*, a name applied in the pharmacopoeial literature to *Bergenia* species and, in southern traditions, to *Aerva lanata* (L.) Juss. ex-Schult.; this is a therapeutically defined name shared across species rather than a single identity.^{16,17} *Indivara*, *kuruntaka*, *morata* and *Vṛkṣadani* remain the least certain entries. The mineral constituents require chemical and pharmacopoeial, not botanical, characterisation.

Ayurvedic Pharmacological Perspective and the Logic of the *Gana*

Ayurvedic pharmacology describes a drug through *rasa*, *Guna*, *Virya*, *Vipaka* and *Karma*, and the value of a *Gana* lies in the assumption that its members share enough of this profile to be mutually substitutable. In *Viratarvadi Gana* the profile is that of *Vata*-pacifying, stone-breaking drugs, several of them diuretic grasses and root drugs; the indications follow from it, and functionally the group is directed at clearing obstructed urine flow and relieving the pain and retention it produces.^{4,9} In *Uṣakadi Gana* the alkaline and saline substances carry a drying, kapha-reducing, fat-scraping action, and salt-and-alkali therapy is the classical rationale for dissolving concretions; substances of this type appear in *Lekhanavasti* context, where a reducing

action is sought.^{4,8}

Ayurvedic action terms map imperfectly onto modern pharmacology: *Mutrala* to diuresis, *Ashmarighna* to lithotriptic activity, *Sothahara* to anti-inflammatory action, *Vedanasthapana* to analgesia and *Kṛmighna* to antimicrobial activity. These mappings are conceptual, not synonymous, and each is treated here as a hypothesis.

The Ayurvedic Concept of Urinary Disorders

Urinary disorders centre on the *Mutravaha Srotas*, the channels carrying mutra from formation to excretion. *Mutrakṛcchra* denotes painful, difficult micturition, grouped by Sushruta among the urinary diseases of the *Uttaratantra*.¹⁸ *Mutraghata* denotes obstruction or retention, including mechanical obstruction; the two categories are closely related.^{18,19} *Ashmari* denotes calculus and is described as of four types distinguished by the *Doṣa* involved, arising from aggravated *Vata* interacting with *Kapha* and *Pitta* and from dietary factors promoting concretion of urinary constituents. The *Nidanasthana* describes the obstructive and painful features of the established stone, and the *Chikitsasthana* sets out management, which in *Sushruta* includes operative removal of bladder stone alongside medical measures.²⁰

This account should be read on its own terms: the four-*Doṣa* typology classifies patients, not stones, and there is no classical equivalent of stone analysis or urine culture. What the texts provide is a consistent picture of obstructed, painful urinary flow with stone-directed, diuretic and kapha-reducing drugs.

Therapeutic Rationale of the Two Gana

Uṣakadi Gana is indicated in calculus, gravel, dysuria, abdominal tumour and kapha excess; its classical logic is desiccation of *Kapha*, scraping of fat, and dissolution of concretions in the urinary passages. In contemporary terms this raises plausible but unproven questions about urine pH, ionic strength and solute load in modifying calcium salt crystallisation — a genuine mechanism in urology, where alkalinising therapy has a defined role in uric acid stone prevention, but not demonstrated for this. That urine chemistry influences stone formation is established; that the group alters it usefully is untested.^{1,8} *Viratarvadi Gana* is indicated in *Vata*-predominant disorders, calculus, dysuria and the pain of retention. Its

logic is promoting urine flow while relieving spasm and pain, and modern analogues exist for each component - dilution of solutes, relief of spasm, and analgesia so the classical indications are pharmacologically plausible in outline. Plausibility in outline is not evidence of effect.^{1,7,9}

Contemporary Understanding of Urinary Tract Infection

UTI is defined by pathogenic microorganisms in the urinary tract with associated clinical features, and is divided into uncomplicated and complicated disease and, anatomically, into cystitis and pyelonephritis. The principal organism in community-acquired infection is *Escherichia coli*, with *Klebsiella*, *Proteus*, *Enterococcus* and *Staphylococcus saprophyticus* accounting for much of the remainder; *Proteus* is of particular interest for its urease activity and association with struvite stones. Diagnosis combines symptoms, urinalysis and, where indicated, urine culture, with imaging reserved for suspected obstruction or complicated disease. Management is antimicrobial, guided by local resistance data and clinical category, with prompt source control where complicated disease is present.^{2,3}

Resistance is the central constraint. The World Health Organization reports that bacterial resistance was associated with more than 4.7 million deaths globally in 2021, that about one in six laboratory-confirmed bacterial infections was resistant in 2023, and that between 2018 and 2023 resistance rose in over 40 per cent of monitored pathogen–antibiotic combinations at 5–15 per cent annually.¹ A laboratory inhibition zone is not clinical cure.

Contemporary Understanding of Renal and Urinary Calculi

Urolithiasis is the formation of concretions in the urinary tract, most of them in the kidney. Calcium oxalate stones are commonest; uric acid stones follow disorders of purine metabolism and are uniquely amenable to alkalinisation of urine; struvite stones are infection-related and pose particular risk in obstructed systems; cystine stones reflect an inherited transport defect. Risk factors include inadequate fluid intake, dietary and metabolic influences, anatomical abnormality, recurrent infection and family history.¹ Formation proceeds from supersaturation with respect to a salt, through nucleation, crystal growth and aggregation, to retention of a particle in the collecting system. Opposing this are

urinary inhibitors such as citrate, magnesium and macromolecular species. Diagnosis rests on laboratory evaluation with non-contrast computed tomography as the definitive modality. Management ranges from conservative measures and medical expulsive therapy for small ureteric stones, through shock wave lithotripsy, to ureteroscopy and percutaneous nephrolithotomy, with urgent intervention in obstructed infected systems.¹ Urological endpoints — stone-free rate, time to expulsion, recurrence — are precisely defined and are not those reported in most herbal literature.

Potential Relevance of the *Gana* to Urinary Tract Infection

Neither *Gana* has a classical indication recognisable as bacterial urinary infection. *Mutrakṛcchra* overlaps symptomatically with cystitis and *Mutraghata* with obstructed infected retention, but the texts attribute the features to *Doṣa* imbalance rather than to a pathogen. The question is not whether these *Gana* treat UTI — no clinical evidence establishes that — but whether constituent drugs possess properties relevant to infection, at a stated level of evidence.

In vitro work exists for several members. Extracts of *Barleria prionitis*, one accepted identity of *Sahachara*, have shown antibacterial activity in culture and diuretic activity in animals.²¹ Preparations of *Oroxylum indicum*, the *Syonaka* identity of *Bhalluka*, have shown antimicrobial and anti-inflammatory activity preclinically.^{22,23} *Achyranthes aspera*, identified with *Vasuka* in some editions, has documented animal diuretic activity and has been examined for crystallisation inhibition in vitro.^{24,25} *Desmostachya bipinnata* has shown animal diuretic activity.¹⁰ A review of *Ferula assa-foetida* summarises antimicrobial activities of *Hingu*.²⁶

Almost all of this is in vitro or animal, often on solvent extracts rather than classical preparations and on single plants rather than the whole *Gana*. It supports the proposition that several constituents possess biological activity of a kind that could be relevant to urinary infection or inflammation. It does not support the proposition that either *Gana* treats UTI.

Potential Relevance of the *Gana* to Renal Calculi

The case in urolithiasis is somewhat stronger, though still predominantly preclinical. A rhizome extract of

Bergenia ligulata exerted an antiurolithic effect in a calcium oxalate model, the authors proposing inhibition of crystallisation, and a bioactivity-guided fraction was later tested against ethylene glycol-induced calculi in rats.^{27,28} These are animal and in vitro data, and the mechanism is crystallisation-inhibitory rather than litholytic. *Aerva lanata*, one candidate identity of *Asmabhedaka*, has been studied for diuretic and antiurolithic activity, including in silico screening of constituents.^{16,29} *Achyranthes aspera* has been reported to reduce oxalate-induced injury to renal tubular cells and to inhibit calcium oxalate crystallisation in vitro.²⁵ *Desmostachya bipinnata* reduced calculus formation in an experimental model and showed animal diuretic activity.^{10,30} *Tribulus terrestris* is often cited in this connection but is not a member of either *Gana* and marks the boundary of this review.^{31,32}

Controlled human evidence specific to these *Gana* is absent. One randomised controlled trial reported that *Palasa Kṣhara* with an *Ashmarīhara* kvatha was more effective than placebo in *Mutrashmari*.³³ That trial supports investigation of stone-directed Ayurvedic therapy, but it tests neither *Gana* reviewed, and animal findings must not be transferred to the clinical setting.

Phytochemical and Pharmacological Evidence

Phytochemical work on the terrestrial constituents includes flavonoids and iridoids in *Barleria*, baicalein and related flavonoids in *Oroxylum indicum*, and saponins in *Achyranthes*.^{21,22,24} Such compounds are reported to possess antioxidant and antimicrobial activity, but the inference from these properties to stone prevention or infection cure is not sure: antioxidant activity does not prevent stone formation, and antibacterial activity in culture does not predict clinical resolution of infection. The mechanisms actually tested for the drugs discussed above are crystallisation inhibition, reduced oxalate-induced epithelial injury, and diuresis, each in non-clinical models.^{25,27,29,30} The mineral constituents require pharmacopoeial rather than phytochemical characterisation.⁸

Integrated Ayurvedic-Contemporary Interpretation

The following sequence is a conceptual model only, not a validated translational framework, and no step in it has been confirmed end-to-end for either *Gana*: concept

Table 1. Classical Composition and Contemporary Evidence of *Uşakadi* and *Viratarvadi Gana*

Gana	Drug	Classical attributes / indication	Botanical / material identification	Contemporary evidence	Potential urinary relevance	Evidence limitation
Usakadi	Ushaka (alkaline earth)	Kapha-mitigating; calculus, gravel, dysuria	Mineral alkali; chemical, not botanical	No direct pharmacological study located	Urine pH / solute effect - hypothetical	Uncertain / insufficient
	Saindhava (rock salt)	Kapha-mitigating; calculus, gravel	Mineral (halite)	No direct study located for this indication	Ionic load and crystallisation - hypothetical	Uncertain / insufficient
	Shilajatu (mineral exudate)	Rasayana; urinary and metabolic use	Bituminous exudate; pharmacopoeial specification required	General reviews; composition variable	Not established for calculus	Variable composition; adulteration risk
	Kasisa (two kinds)	Astringent, drying; wound and urinary use	Metallic sulphates	No direct study located for this indication	Not established	Uncertain / insufficient
	Hingu (asafoetida)	Vata-kapha pacifying; abdominal pain	Ferula assa-foetida L. (Apiaceae), oleo-gum-resin	Review: antimicrobial, anti-inflammatory, antispasmodic	Antispasmodic / analgesic plausibility	Mostly preclinical; not urinary-specific
	Tutthaka (copper sulphate)	Drying, cleansing	Mineral salt	Toxicological caution rather than efficacy data	None established	Safety concern at systemic dose
Veetarvadi	Veetaru (Virataru)	Vata-pacifying; calculus, dysuria, retention	Disputed; Dichrostachys cinerea proposed	No direct study located	Not established	Uncertain / insufficient
	Sahacara (two kinds)	Vata-pacifying; urinary and inflammatory use	Barleria prionitis L. or Strobilanthes ciliatus Nees (disputed)	In vitro antibacterial; animal diuretic	Antimicrobial / diuretic plausibility	In vitro and animal only
	Darbha	Cooling, diuretic, galactagogue	Imperata cylindrica (L.) P. Beauv. (Poaceae)	Diuretic and anti-inflammatory reports	Diuresis - plausible mechanism	Animal / observational
	Kusha	Cooling, diuretic; urinary complaints	Desmostachya bipinnata (L.) Stapf (Poaceae)	Animal diuretic; reduced calculus in experimental model	Diuresis; crystal inhibition	Animal only
	Kasha	Cooling, diuretic	Saccharum spontaneum L. (Poaceae)	Reported diuretic use; limited direct study	Diuresis - plausibility only	Insufficient
	Ashmabhedaka	Stone-breaking; calculus, gravel	Name shared across species; Bergenia spp. / Aerva lanata proposed	Animal antiurolithic (Bergenia); diuretic and in silico (Aerva)	Crystallisation inhibition	Animal and in vitro; identity uncertain
	Agnimantha	Vata-pacifying; anti-inflammatory	Premna spp. (Lamiaceae); Clerodendrum also recorded	Anti-inflammatory; nephroprotective in a polyherbal context	Anti-inflammatory plausibility	Preclinical; identity variation
	Vasuka (Apamarga)	Diuretic; urinary disorders	Achyranthes aspera L. (Amaranthaceae)	Animal diuretic; in vitro crystallisation inhibition and epithelial protection	Diuresis; crystal inhibition	Animal and in vitro
	Bhalluka (Shyonaka)	Anti-inflammatory; vata-kapha disorders	Oroxylum indicum (L.) Benth. ex Kurz (Bignoniaceae)	In vitro antimicrobial; animal anti-inflammatory	Anti-inflammatory / antimicrobial	Preclinical
	Kapotavanka	Vata-pacifying	Dalbergia lanceolaria L.f. proposed; Suvarcla also given	No direct study located	Not established	Uncertain / insufficient
	Remaining entries	Vata-pacifying; calculus, gravel, dysuria	Variously and inconsistently identified	No direct study located for the group indication	Not established	Uncertain / insufficient

(*Ashmari*, *Mutrakṛcchra*, *Mutraghata*) → Ayurvedic rationale (stone-breaking, diuretic and vata-pacifying drugs) → potential contemporary interpretation (crystallisation inhibition, increased urine output, relief of spasm, analgesia, anti-inflammatory action) → available evidence (in vitro crystallisation and bacterial inhibition; animal diuresis and reduced calculus formation; no controlled human data for the groups) → limitation (identity uncertainty, extract versus crude-drug differences, absent clinical endpoints) → research requirement (authenticated, standardised material; mechanistic work; controlled trials with urological endpoints).

Safety and Clinical Limitations

Several limitations bear on patient safety. Botanical identity is unresolved for several constituents, and where a classical name maps onto more than one species the literature may describe a plant that is not the one dispensed.^{12,13,15} Standardisation is consequently difficult, since crude drug, decoction, extract and processed mineral preparation are pharmacologically distinct. The mineral members demand particular caution, as several are metallic sulphates with dose-dependent toxicity, and the impurity profile of silajatu is variable.⁸

Herb–drug interactions are plausible and largely uncharacterised, and impaired renal function makes unmonitored mineral intake a genuine hazard.

Traditional urinary formulations must not be presented as substitutes for antimicrobial therapy where infection is established, for analgesia in renal colic, or for drainage in an obstructed infected system — situations in which delay risks pyonephrosis, sepsis and loss of renal function.^{1,2} Sushruta himself described operative removal of bladder stone alongside medical management.²⁰

Research Gaps

Authentication comes first: no pharmacological conclusion is meaningful until each constituent has been identified to species or pharmacopoeial specification by accepted methods, with voucher specimens deposited. Standardised extract and dosage-form manufacture follows, with marker-based quantification and stability data. The experimental programme then divides into an in vitro tier — antimicrobial susceptibility testing against uropathogens, anti-adhesion assays, crystallisation and aggregation inhibition, effects on urinary pH, citrate and inhibitor concentrations and an animal tier using established urolithiasis models with toxicology and

Table 2. Classical Composition and Contemporary Evidence of *Uṣakadi* and *Viratarvadi Gana*

Therapeutic domain	Ayurvedic rationale	Contemporary mechanism / evidence	Evidence level	Research gap
Diuresis / urine flow	Mutra-driving action; clearance of obstructed urine	Animal diuretic activity reported for Kusha, Vasuka and Sahacara	Animal	Human diuretic and pharmacokinetic studies; effect on stone expulsion
Crystallisation inhibition	Ashmari-destroying action; stone- and gravel-directed use	In vitro and animal inhibition of calcium oxalate crystallisation (Ashmabhedaka sources)	In vitro / animal	Mechanistic studies on identified constituents; relevance at achievable urinary concentrations
Analgesia / antispasmodic	Pain-relieving action; relief of retention pain	Antispasmodic and analgesic reports for Hingu; anti-inflammatory for Agnimantha and Shyonaka	Preclinical	Clinical studies of pain endpoints in renal colic
Antimicrobial / anti-infective	Antimicrobial action; symptomatic overlap with painful micturition	In vitro antibacterial activity for Sahacara and Shyonaka; asafoetida reviews	In vitro	Clinical trials; anti-adhesion studies; no evidence for the Gana as an anti-infective
Anti-inflammatory	Reduction of inflammatory swelling	Animal and in vitro anti-inflammatory activity in constituent plants	Animal / in vitro	Human studies; separation of symptomatic relief from disease modification
Urinary tract protection	Protection of the urinary channels	Reduced oxalate-induced injury to renal tubular cells in vitro (Vasuka, Ashmabhedaka sources)	In vitro	In vivo confirmation; identification of protective constituents
Clinical efficacy of the Gana	Grouped prescribing across the classical indications	No controlled trial of either Gana identified; one randomised trial exists for a different calculus formulation	Human clinical (other formulation only)	Standardised extracts, randomised controlled trials, dose standardisation
Diuresis / urine flow	Mutra-driving action; clearance of obstructed urine	Animal diuretic activity reported for Kusha, Vasuka and Sahacara	Animal	Human diuretic and pharmacokinetic studies; effect on stone expulsion

renal-function monitoring. Only then are controlled human studies defensible, with urological endpoints such

as stone size change and time to expulsion, and, for infection, symptom resolution with microbiological

confirmation.^{1,33} Existing Gana-focused reviews are largely descriptive and rarely apply an evidence hierarchy.^{5,9,34}

Future Directions

A realistic agenda would begin with coordinated authentication and pharmacognosy for both *Gana*, recording competing identifications rather than resolving them by preference. Standardised extracts of the authenticated botanical members, and characterised mineral preparations of the *Usakadi* substances, would then be screened in integrated panels combining antimicrobial, diuretic, crystallisation-inhibitory and anti-inflammatory assays in one protocol. Molecular work on oxalate transport, crystal–matrix interactions and epithelial injury pathways would clarify whether preclinical signals reflect a genuine urinary mechanism. Clinical work should follow with patient phenotyping by stone composition rather than classical label alone, since a four-dosa typology and a crystallographic classification are not interchangeable, and UTI and calculus populations must be separated. Quality-control standards, dose standardisation and pharmacovigilance should be built in from the outset. These are proposals, not established evidence.

Conclusion

Uṣakadi Gana and Viratarvadi Gana merit systematic examination on the strength of their textual position. They are preserved in the grouping chapter of the Sushruta Samhita – Sutrasthana 38 rather than 37, as the verification in this review established – and carry coherent indications in calculus, gravel, dysuria and obstructed micturition. Those indications should be interpreted within their original context, in which *Ashmari* and *mutrakṛcchra* are functional categories shaped by doṣa and srotas theory rather than by microbiology or crystallography. Direct equivalence between these concepts and the modern diagnoses should not be assumed, and UTI and urolithiasis should not be treated as identical conditions. Selected constituent drugs do have properties that may be relevant, but the evidence is predominantly in vitro and animal and almost entirely absent for the *Gana* as complete formulations. It is reasonable to say that studies of *Bergenia*, *Achyranthes*, *Desmostachya*, *Barleria* and *Oroxylum* have reported crystallisation

inhibition, diuresis and antimicrobial or anti-inflammatory activity. It is not reasonable to say that either Gana has been shown to treat UTI or renal calculi, and the single randomised trial identified tested a different formulation.³³ These Gana are best regarded as textually well-founded, pharmacologically interesting and clinically unproven. lacks is not plausibility but rigour: adequately powered trials with ambulatory endpoints, active comparators, long follow-up and mechanistic embedding. Until such evidence exists, *Pranayama* is best offered to hypertensive patients as a safe, inexpensive and well-accepted adjunct to lifestyle and pharmacological management—useful, but never a replacement for either.

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Conflicts of Interest

There are no conflicts of interest.

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