Journal of Animal Environment

(E-ISSN 2717-1396, ISSN 2717-1388)

Original Research Paper

Identification and Categorization of Pathogens in Doshaja Mutrakrucchra vis-à-vis Urinary Tract Infections

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Abstract

Background: *Mutrakrucchra* is a disease characterized by difficulty in voiding of urine. The *Lakshana* of *Mutrakrucchra* mentioned in Ayurveda literature appears similar to the clinical features of urinary tract infections caused by microbes. Hence, this study was conducted to bridge *Ayurveda* classical knowledge to modern microbiology understanding to characterize microorganisms causing different types of *Mutrakrucchra,* which can be a torch bearer for future clinical approach in cases of *Mutrakrucchra.* **Objectives:** To identify the microorganisms in urine among the patients of *Ekadoshaja Mutrakrucchra.* To differentiate and classify the microorganisms present in the *Mutra* among *Vataja, Pittaja, Kaphaja Mutrakrucchra.* **Methodology:** This was a cross – sectional study which included 44 subjects. Subject's urine sample was collected and subjected for microscopic examination, culture and incubated for 24-48 hours. After incubation, the growth in agar media was observed for growth characteristics and later the colonies was subjected for Gram staining, Microscopic observation and Biochemical tests for identification of the microorganisms. *Vataja, Pittaja and Kaphaja Mutrakrucchra* was correlated with that of organisms found on growth. **Results:** Fisher's exact test demonstrated a statistically significant association between *Vataja Mutrakrucchra* and *E.coli* (p-value of 0.003), as well as between *Pittaja Mutrakrucchra* and *Klebsiella* (p-value of 0.028), indicating statistically significant correlation. **Conclusion:** *Pittaja Mutrakrucchra* is associated with *Klebsiella*, whereas *E.coli* and *Enterococci* are also found in significant number of subjects. *Vataja Mutrakrucchra* is associated with *E.coli* and as *Kaphaja Mutrakrucchra* cases observed were very few, no conclusion could be drawn.

Keywords: *Doshaja Mutrakrucchra, Urine, Urinary Tract Infection, Culture, Agar, E.coli, Klebsiella*

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Received: 25th May, 2026; Revised: 6th July, 2026; Accepted: 28th July, 2026; Available Online: 29th August, 2026

(DOI): 10.70102/AEJ.2026.18.8s.26

1. Introduction

Dosha Dhatu Mala Moolam Sada Dehasya [1]. *Dosha, Dhatu* and *Mala* are the components of our body, whose physiological state defines the health. *Mala Mutra Shakrut Swedaadayo Api Cha* [2]– *Mutra, Purisha, Sweda* are the *Trimala* of the body. *Mutra* does the function of *Vikleda* and *Basti poorana* [3]. The *Moola* of *Mutravaha Srotas* is *Basti* and *Vankshana* [4].

Mutrakrucchra is a disease characterized by difficulty in voiding of urine [5]. This is classified into 8 types – *Vataja, Pittaja, Kaphaja, Sannipataja, Ashmarija, Kshataja, Shukraja* and *Sharkaraja* [6]. The clinical features are similar to that of urinary tract infections caused by microbes.

Urinary Tract Infection (UTI) is infection in urinary tract by pathogenic bacteria, commonly caused by *Escherichia coli, Staphylococcus saprophyticus, Staphylococcus aureus, Enterococcus species, Klebsiella pneumoniae, Citrobacter* species*, Proteus* species*, Acinetobacter, Morganella* species*, Pseudomonas aeruginosa and Yeast* [7].

The prevalence of UTI in women is greater than men. In women 3% of prevalence and increasing by about 1% in each subsequent decade [8].

There is no direct reference mentioned in *Samhita* that *Mutrakrucchra* is caused by *Krimi.* Whereas, based on the similarity in the clinical features, we can understand that UTI is similar to that of *Mutrakrucchra.* Therefore, we can infer that *Mutrakrucchra* can be caused due to *Krimi* also.

The causative organisms of the UTI are the inhabitants of colon and blood [9], from this we can infer that if *Purishaja Krimi* or *Raktaja Krimi* enters *Mutravaha Srotas* and cause *Mutrakrucchra.*

Hence, this study was carried out to identify the microorganisms responsible for causation of *Mutrakrucchra* and to categorize them among *Doshaja Mutrakrucchra*. Thus, this was the first of its kind study to bridge the *Ayurveda* classical knowledge to modern microbiology understanding to characterize microorganisms causing different types of *Mutrakrucchra,* thereby serving as a torch bearer for future clinical approach in cases of *Mutrakrucchra.*

2. Methodology

2.1 Source of Data

Literary Source: All classical and contemporary texts including the journals and concerned websites were reviewed and documented for study.

Sample Source: Subjects were selected from OPD and IPD of JSS Ayurveda Medical College and Hospital, Mysuru, Students and Staff, Medical camps and other referrals.

2.2 Method of Collection of Data

Sample Size: 44 subjects

Diagnostic Criteria: Patients complaining of pain and difficulty in micturition – *Dukhena Mutra Pravrutti & Krucchra Mutra,* Increased frequency of micturition – *Muhur Muhur Mutra Pravrutti.* Diagnosis of *Doshaja Mutrakrucchra* was made clinically, based on clinical features of *Mutrakrucchra* mentioned in the Ayurvedic treatise.

Inclusion Criteria: Subjects willing to participate in this study, fulfilling diagnostic criteria, of any genders and of all the age groups.

Exclusion Criteria: Subjects with *Sannipataja, Sharkaraja, Ashmarija, Shukraja, Kshataja, Shakrut Mutrakrucchra*, subjects with positive HIV, HbsAg, sample of catheter associated urinary tract infection [CAUTI].

2.3 Study Design

This was a cross – sectional study. A case proforma was prepared based on the classical features of *Vataja, Pittaja* and *Kaphaja Mutrakrucchra*. This study was registered in CTRI - CTRI/2025/01/098221. 44 subjects fulfilling the diagnostic criteria were selected for the study.

Subjects' urine sample was collected and subjected for microscopic examination and culture. Culture was done on HiCrome UTI Agar media. A loop of urine was streaked in a horizontal line in the middle of the petri plate, and the specimen was spread all over the plate in a single continuous back and forth movement and incubated at 37^0C for 24-48 hours. After incubation, the growth in agar media was observed for growth characteristics and later the colonies were subjected for Gram staining, Microscopic observation and Biochemical tests for identification of the microorganisms.

Clinical diagnosis of *Vataja, Pittaja and Kaphaja Mutrakrucchra* was correlated with that of organisms found on growth.

Statistical Analysis: Statistical analysis was done by **Fisher's Exact Test**.

3. Observations

A total of 44 subjects of *Mutrakrucchra* were registered and out of those 25% of the cases were diagnosed as *Vataja Mutrakrucchra*, 61.4% cases were *Pittaja Mutrakrucchra*, 6.8% were *Kaphaja Mutrakrucchra*.

Among *Vataja Lakshana, Swalpam Muhur-Muhur Mutrata* was the most commonly observed *Vataja* manifestation, present in 29.5% of the subjects. *Teevra Ruja* in 13.6% of the subjects, while *Teevra Ruja* in *Medra* and *Basti* in 11.4% of the study population.

Among *Pittaja Lakshana, Sadaha Mutra Tyaga* was the most commonly observed *Pittaja* manifestation, present in 54.5% of the subjects, followed by *Krucchram Muhur-Muhur Mutra Pravrutti* in 45.5% of the subjects. *Saruja Mutra Tyaga* and *Ushna* were observed in 36.4% and 29.5% of the study population respectively. *Peeta Mutra* was present in 20.5% of the subjects, whereas *Sarakta Mutra* was observed in 11.4% of the subjects.

Among the patients of *Kaphaja Mutrakrucchra, Bahala Mutra* was present in 6.8% of the subjects,

followed by *Sapicchila Mutra* observed in 4.5% of the study population.

Katu Rasa Pradhana Ahara was noted in 70.5% of the patients, *Lavana Rasa Pradhana Ahara* in 56.8%, *Ushna Ahara* in 25% of cases, *Anupa Mamsa Sevana* in 40.9% cases, *Ajeerna* in 31.8% and *Vegadharana* among 50% of cases.

In microscopic examination, WBC of 4-6/HPF was noted among 29.5% cases and plenty WBC in 22.7% cases, 8-10/HPF among 13.6% of study population, 15–20 /HPF in 11.4% cases.

Plenty motile bacteria was present in 84.1% of subjects, indicating bacteriuria.

In bacterial culture, *Escherichia coli* was the most commonly isolated primary organism, identified in 40.9% of the subjects, followed by *Klebsiella* observed in 25% of the study population. *Enterococci* constituted 18.2% of the isolates, whereas *Staphylococcus* was identified in 6.8% of the subjects. *Citrobacter, Pseudomonas, Candida*, and *Enterobacter* were each isolated in 2.3% of the subjects.

Among subjects diagnosed with *Vataja Mutrakrucchra*, *Escherichia coli* was the predominant isolate observed in 81.8% of the subjects, followed by *Enterococci* identified in 18.2% of the subjects. Among *Pittaja Mutrakrucchra* subjects, *Klebsiella* was the most commonly isolated organism observed in 37% of the subjects, followed by *Escherichia coli* identified in 22.2% of the subjects. *Enterococci* constituted 14.8% of isolates among *Pittaja* subjects, while *Staphylococcus* was identified in 11.1% of the cases. *Citrobacter*, *Pseudomonas*, *Candida*, and *Enterobacter,* were each isolated in 3.7% of *Pittaja* subjects.

4. Results

Fisher's Exact test revealed a statistically significant association between *Escherichia coli* isolation and *Vataja Mutrakrucchra* ($p = 0.003$). This indicates that subjects with *Vataja Mutrakrucchra* demonstrated significantly higher occurrence of *Escherichia coli* compared to other *Doshaja Mutrakrucchra* subjects.

Fisher's Exact test revealed a statistically significant association between *Klebsiella* isolation and *Pittaja Mutrakrucchra* ($p = 0.028$). This indicates that subjects with *Pittaja Mutrakrucchra* demonstrated significantly higher occurrence of *Klebsiella* compared to other *Doshaja Mutrakrucchra*.

5. Discussion

Katu, Lavana, Ushna Ahara, Ajeerna And Anupa Mamsa [10] are considered as *Dosha Prakopaka Hetu*. These *Nidana* specifically cause *Dushti* in *Mutravaha Srotas* results in *Mutrakrucchra*. *Mutravaha Sroto Dushti Nidana- Mutrita Udaka Bhakshya Stree Sevana, Mutra Nigraha, Abhikshata, Ksheena* [11] these are considered as *Vyadhi Hetu*.

Holding of urine from not voiding which has proved to be a potential risk factor for UTI, the harbored pathogens near urethral opening are flushed out in the process of micturition, withholding of urine causes bacterial pathogens to multiply and ascend to kidneys and causes infection [12].

Pain is the inherent character of *Dushta Vata* and in general practice *Vata* and pain are almost always viewed as synonymous characters.

While describing *Dushta Vata Karma* [13] and *Vataja Nanatmaja Vikara*, *Acharya Charaka* describes different characters of pain, which depict the inevitable role of *Vata* in the genesis of pain. This description is further prioritized by *Acharya Sushruta*, where the description says that, there can be no pain without involvement of *Vata* [14].

With the above said descriptions, role of *Vata* in the genesis of *Shoola* can be interpreted.

In relation to the current disease of interest, the primary clinical features in *Vataja Mutrakrucchra* is presence of *Teevra Ruja* in *Vankshana, Medra, Basti*. *Basti* along with its surrounding structures are predominantly harbored by *Apana Vata*. When *Apana Vata Dushti* happens in *Basti*, due to specific *Vyadhi Hetu*, it results in production of primary clinical features of *Shoola*.

Vata considered as the primary regulator of the neuronal activity in the body. During its *Vikriti*, it brings about irregularity in neuronal signaling and reflects in the innervated organs. *Vata Vriddhi* causes increased sensitivity of bladder sensory nerves which rather causes increased sensory input and reflex from the centers resulting in repeated stimulation of detrusor muscle and sphincter relaxation resulting in repeated urge to micturate.

Ushna and *Teekshna Guna* are considered as *Atma Guna* of *Pitta*. When *Pitta* is *Prakupita*, these qualities bring about *Daha, Aushnyata, Paka, Sweda, Peetam, Sarakta, Saruja, Krucchra Mutra Pravrutti, Muhur Mutra Pravrutti*.

Pitta in the form of *Agni* is responsible for proper formation and composition of all *Avayava* in *Sharira* including *Dhatu* and *Mala*, *Vikruta Pitta* results in improper composition and formation of *Mutra* also, which thus forms *Mutra* with abnormal physical characteristics and chemical composition.

Peeta Varna is a pathological change in colour of urine and it is a *Pittaja Nanatmaja Vikara*, where for these changes to happen, involvement of pitta is absolutely necessary. Change in colour of urine can be attributed to change in composition of urine, which can occur due to systemic disorders, disease of kidneys and/or disorders of urinary tract.

Acharya Sushruta says, pitta has an invariable role to play in the pathogenesis of *Paka*, which when present in any part of the urinary tract brings about changes in colour of urine.

Changes in the composition of urine brings about *Daha, Krucchrata* which may be attributed to lower

pH of urine, which can be understood as increased *Ushna* and *Tikshna Guna* of *Pitta*.

Bladder dysfunction in Diabetes Mellitus/ Diabetic cystopathy refers to lower urinary symptoms due to diabetic neuropathy [15]. Diabetic cystopathy is characterized by increased post voiding residual volumes causes asymptomatic increase in bladder capacity and urinary retention occurs, voiding reflexes becomes sluggish, urgency with or without incontinence, urinary frequency and nocturia, difficulty in initiation and maintain micturition this may be interpreted as *Gurutva* and *Shopha* of *Basti, Medra, Mushka, Sapicchila Mutra, Bahala Mutra, Alpa Badha* during *Mutra Tyaga*.

Picchilata is one of the *Atma Rupa* of *Kapha* and when *Kapha Vriddhi* happens *Picchila Guna Vriddhi* also follows, which gets reflected in the urine.

6. Discussion on Results

Pitta is invariable for the genesis of *Paka*-inflammation. UTI comprises of cystitis and urethritis, where inflammation is again a major step in pathogenesis. Among 27 subjects of *Pittaja Mutrakrucchra*, *Klebsiella* is found to be common, albeit all other organisms are also grown from the urine of these subjects. These observations maybe understood by the involvement of *Dushta Pitta* in the genesis of inflammation, which aids the inflammatory changes being brought by the invading organism.

Klebsiella has emerged as a major cause of healthcare associated opportunistic infections [16].

The pathogen is similar to UPEC, uses two types of fimbriae adhesin for biofilm formation and bladder colonization. Two types of fimbriae adhesins have different binding specificities. Type-1 fimbriae bind to mannose receptors in the urinary tract and promote bladder cell invasion. Type-3 fimbriae, do not bind to mannose receptors but play a important role during biofilm aggregation.

The characteristic attributes of *Vataja Mutrakrucchra* are *Teevra Ruja* in *Vankshana*, *Medra, Basti* and *Swalpam Muhur-Muhur Mutra Pravrutti*, these features co-relate with features of UPEC induced UTI which presents with overactive bladder with smaller mean volume per void, pelvic allodynia.

Uropathogenic *Escherichia coli* [UPEC] [17] expresses several bacterial virulence factors such as lipopolysaccharide [LPS], flagella and -hemolysin, which enable them to overcome the host immune response and successfully initiate and maintain urothelial infection because the terminal fibers of bladder sensory neurons reside in the urothelium and in a subepithelial plexus within lamina propria, bacterial components and toxins released in the course of urothelial infections affects the functions. UPEC virulence factors affects directly on the bladder afferents to promote their sensitization. UPEC causes urothelial hypertrophy in the bladder, exhibits overactive bladder with high number of voiding events and smaller mean volume per void. UPEC presents with inflammation in the bladder mucosa and lamina propria, increased voiding frequency and pelvic allodynia, these are associated with an increase in the excitability of sensory neurons with TTX-S and TTX-R action potentials. Bladder infections trigger a robust innate inflammatory response, pain related to bacterial infection is secondary to the activation of the immune system. Pain is a complex sensory process mediated by peripheral and central neuronal pathways. Sensitization of primary afferent fibers is a fundamental process in pain perception.

7. Conclusion

Based on the present study titled “Identification and categorization of pathogens in Doshaja Mutrakrucchra vis-à-vis urinary tract infections”, *Pittaja Mutrakrucchra* is associated with *Klebsiella*, whereas *E. coli* and *Enterococci* are also found in significant number of subjects. *Vataja Mutrakrucchra* is associated with *E. coli*. No conclusions could be drawn in favor of *Kaphaja Mutrakrucchra* as the observed cases were very few.

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