Clinical evaluation of Antimicrobial activity of Kantakari (Solanum xanthocarpum Schrad & Wendl) in Lower Urinary Tract Infection (Mutrakruchchra)

Shintre Sayali¹, Ramteke Ashok² and Shelke Rajashree³

¹Dept of Dravyagunvigyan, School of Ayurveda, Dr D. Y. Patil deemed to be University, Nerul, Navi Mumbai, MS, India
²,³Dept of Dravyagunvigyan, A.P.M’s Ayurved Mahavidyalaya, sion, Mumbai, MS, India

ABSTRACT
Infectious diseases still possess a threat to mankind. Lower Urinary tract Infection (LUTI) is the second most common infection affecting human beings. The symptoms of ‘mutrakruchchra’ mentioned in Ayurveda closely correspond to the symptoms of LUTI. Resistance to antimicrobial agents is a rising concern today. Various herbal extracts are being studied constantly for their antimicrobial activities as the problem of microbial resistance is increasing. Kantakari is widely available traditionally used Ayurvedic herb. References from Ayurvedic literature suggests Kantakari (Solanum xanthocarpum Schrad&Wendl) to be effective in Mutrakruchchra. Total 60 patients of Lower Urinary tract infection involved in this clinical trial were randomly divided into two groups. Group A of 30 patients were administered kantakari panchang kwath (Decoction) for a period of 7 days and Group B of 30 patients were subjected to Tab Norflox TZ for 5 days. The observations were recorded and analysed statistically on the basis of objective parameter of reduction in pus cells in both the groups. Symptomatic relief in group A (Kantakari kwath) was 89.11% and that in group B was 92.16%. Paired t test applied in group A and B were extremely significant at p value <0.0001. Unpaired ‘t’ test between both groups was not significant. Kantakari showed equivalent results as compared to standard antibiotic. It was found to be effective single herb in Mutrakruchchra.

KEYWORDS
Lower Urinary tract Infection, Mutrakruchchra, kantakari, Antimicrobial activity
INTRODUCTION
Lower Urinary tract infections (which can be correlated to Mutrakruchchra in Ayurveda), is a rising health problem and affects large population across the globe every year. Kantakari (Solanum xanthocarpum Schrad&Wendl) is a well-known Ayurvedic herb and also a part of famous combination ‘dashamool’. Acharya Sushrata has quoted- 

निदिनिधिकाया: 
स्यरसंपिकितुदुडवसम्भितम् 
मूत्रदेशवरक्ल्यंअथया क्षौदसंयुतम् 
(सु.उ.५८/३९)
It means kantakari juice is effective with or without honey in urinary complaints and disorders¹. It is also advised in krimi and ama. With this view, Kantakari was selected for study.

AIMS AND OBJECTIVES
➢ To evaluate the Lower Urinary tract infection as per Ayurveda
➢ To do the clinical evaluation of Antimicrobial activity of Kantakari(Solanum xanthocarpum Schrad & Wendl) in Lower Urinary tract infection(Mutrakruchchra)
➢ To compare the Antimicrobial activity of Kantakari(Solanum xanthocarpum Schrad & Wendl) with standard antibiotic Norfloxx Tz

MATERIALS & METHODS
Kantakari was reviewed in Samhitäs (classical texts) and nighantus (lexicons) of Ayurveda. Also, the recent researches on kantakari were scrutinized. The test drug was standardized before using in clinical trial. The randomized clinical study was undertaken in O.P.D of Ayurved Mahavidyalaya, Sion, Mumbai after approval of Institutional Ethical Committee (Institutional Ethical committee approval no-AMS/1950/2018/1). Total 60 patients involved in this trial were randomly divided in two groups. 30 patients in group A were given Kantakaripanchangkwath 30-40 ml before meals thrice a day for 7 days and 30 patients in Group B were given Tab Norfloxx Tz B.D for 5 days. Observations were recorded and results were discussed based on statistical analysis.

CRITERIA OF SELECTION OF PATIENTS-
Inclusion criteria:
Age: 16-70yrs, Sex: male and female both included.
Informed and consent signed.
Patients having sign and symptoms of mutrakruchchra (Lower Urinary Tract Infection) with positive Urine Microscopy
Signs and symptoms of *mutrakrchchra*: -

- *Sakruchchramutrapravritti* (Dysuria).
- *Sadahamutrapravritti* (Burning micturition).
- *Vankshanbastimedhrashoola* (Suprapubic pain).
- *Muhurmuhurmutrapravritti* (Increased frequency of micturition).

**Exclusion criteria:**

- Patient with sterile urine specimen (Pus cells in Urine ≤ 5)
- Those suffering from T.B, Malignancy, Diabetes mellitus
- Patient with severe systemic illness and immunocompromised persons.
- Pregnant and lactating women.

**Drug administration details:**

- Drug source: - *Panchanga* (roots, fruits, leaves, stem, flowers) of Kantakari (*Solanum xanthocarpum. S & W.*)
- Formulation: Decoction (*kwath*).
- Mode of Administration-Oral.
- Dose – 30 to 40ml T.D.S  *Kaal:* Before Meals (*Prabhakta*)

**Follow-up:** 3 days after first visit. 7 days after first visit

**Assessment criteria- SUBJECTIVE:**

Symptoms mentioned in text were assessed at each follow up. Symptoms were arbitrarily graded into 4 grades (0-3) on basis of severity.

1) *Sakruchchramutrapravritti* (Dysuria).
   - No pain - 0
   - Mild pain while micturition - 1
   - Moderate pain while micturition - 2
   - Severe pain while micturition-3

2) *Sadahamutrapravritti* (Burning micturition).
   - No burning sensation- 0
   - Mild burning sensation while micturition- 1
   - Moderate burning sensation while micturition - 2
   - Severe burning sensation while micturition-3

3) *Vankshanbastimedhrashoola* (Suprapubic pain).
   - No pain - 0
   - Mild pain - 1
   - Moderate pain - 2
   - Severe pain -3

4) *Muhurmuhurmutrapravritti* (Increased frequency of micturition).
   - frequency 4-6times a Day/1-2 Night- 0
   - frequency 7-10 times a Day/3-4 Night - 1
   - frequency 11-14 times a Day/5-6 Night - 2
   - frequency >15 times a Day/7 Night -3
OBJECTIVE CRITERIA- Urine-Routine, microscopic and culture Examination
Statistical analysis was done for the objective criteria of decrease in pus cells in urine microscopic examination by applying Paired student ‘t’ test in individual groups and unpaired ‘t’ test between both the groups.

RESULTS
Evaluation of the study was done statistically. Total symptomatic percentage relief (Table1.) in group A (test drug Kantakari panchang Kwath) was 89.11% and B (Standard antibiotic-Norflox TZ) was 92.61%. that is both Kantakari panchang kwath and standard antibiotic showed significant relief (> than 75%) in symptoms of L.U.T.I(Figure 1.). Objective parameter (Table 2.) assessed in both groups before and after the treatment was Pus cells (leucocytes). In Group A, value was 8.073 with 29 degrees of freedom (n-1) for which p value is < 0.0001, considered extremely significant (at 95% confidence interval) In Group B, t value was 4.926 at 29 degrees of freedom (n-1) for which p value is < 0.0001, considered extremely significant at 95% confidence interval.

Table1 Total effect of subjective parameters
<table>
<thead>
<tr>
<th>Symptom</th>
<th>% relief</th>
<th>Symptom</th>
<th>% relief</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sakrucchramutrapravrutti</td>
<td>86.36</td>
<td>Sakrucchramutrapravrutti</td>
<td>90</td>
</tr>
<tr>
<td>Sadaha mutra pravrutti</td>
<td>88.23</td>
<td>Sadaha mutra pravrutti</td>
<td>92.5</td>
</tr>
<tr>
<td>Vankshanbastimedhrashool</td>
<td>91.66</td>
<td>Vankshanbastimedhrashool</td>
<td>95.23</td>
</tr>
<tr>
<td>Muhurmuhurmutrapravrutti</td>
<td>91.89</td>
<td>Muhurmuhurmutrapravrutti</td>
<td>94.11</td>
</tr>
<tr>
<td>Total</td>
<td>89.11%</td>
<td>Total</td>
<td>92.61%</td>
</tr>
</tbody>
</table>

Fig 1 Graphical representation of Total Percentage effect of Therapies in Grp A and Grp B

Table 2 Statistical Analysis for Objective Criteria (Pus Cells/Leucocytes)-

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>GROUP-A</th>
<th>GROUP-B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean((\bar{x}_1))</td>
<td>SD</td>
</tr>
<tr>
<td>PUS CELLS (LEUCOCYTES)</td>
<td>11.667</td>
<td>7.216</td>
</tr>
</tbody>
</table>

For unpaired t test between two groups is considered not significant.
DISCUSSION

Hetus of mutrakruchhra disease highlight tridoshaparakopakahetuts in disease formation\(^2\). There are 2 sampraptis of this disease, either vitiation of all three doshas or vitiation of individual doshas, followed by further samprapti\(^2\). Symptoms of mutrakruchhra correlate with the symptoms of L.U.T.I and Mutrakruchhra is categorized into santarpanotthavyadhi. Pakvaashaya is the place for urine formation according to Ayurveda. The relation between pakvashaya and basti needs to be studied further. Escherichia coli, the main causative organism of U.T.I is the normal resident of intestine, unless it gains entry in bladder.

Antimicrobial Activity -
Besides the Krimighna, vishaghna karmas, Deepan and Paachan karmas of dravya should be thought of while understanding antimicrobial activity in my opinion. Mutrakruchhra is a santarpanotthavyadhi which means the pathogenesis consist of kaphavruddhi, followed by dhatwagnimandya and ama (kleda) formation. Kleda is the origin of krimis. So, treatment should aim at two levels-

- To treat dhatwagnimandya-deepana.
- To remove kleda- pachana. This specifically means the ‘ama’pachana karma.

Kleda is also known as the ama formed at the dhatu level due to dhatwagnimandya. Normally it is carried out of body through urine (Mutrasya kledavahanam). However, in infection, kleda increases due to dhatwagnimandya, it is carried by urine, which is stored in bladder. Due to factors like vegavidharana etc, this urine facilitates growth of krimis(microorganisms). So basic treatment in UTI should be deepan and paachana at dhatwagni level. Thus, dravyas having these two properties should be wisely selected while implementing them as antimicrobials.

Probable mode of action of Kantakari in Sampraptibhanga of L.U.T.I
(Mutrakruchhra) (Figure 3)- Tikta,katu rasa and rukshagunas account for kapha shaman, the tikta rasa also contribute to
amapachana and rasa, raktadhatwaagnideepana. It facilitates the removal of kleda from the body through mutra (as quoted mutrasyakledavaahanam) as it has diuretic property.

![Diagram](image_url)

Fig 3 Diagrammatic representation of Probable mode of action of Kantakari in L.U.T.I. (Mutrakruchhra)

**Discussion on Clinical Study**

Demographic analysis revealed that Lower urinary tract infection (mutrakruchhra) affected female population more in comparison to male (Out of total 60 patients 23 (38.33%) were males and 37 (61.66%) were females.). It affected maximum population with 61-70 years of age. It manifested more in persons with mixed diet, in those with madhyamkoshtha and those whose agni was manda. Maximum affected population i.e 48 (80%) had tendency of vegavidharan, 12(20%) had no such tendency). Maximum microorganism isolated in culture was Escherichia coli (Out of 60 patients, 76.66% were infected with Escherichia coli, 16.66% with enterococcus faecalis, 3.33% Klebsiella pneumoniae, 1.66% with proteus mirabilis, 1.66% from pseudomonas aeruginosa).

Symptomatic relief was excellent in both the groups (kantakarikwath and Tab. NorfloXt) after intervention. Also, the pus cells decreased significantly in both the groups after treatment. Overall effect of therapy was excellent in both groups.
CONCLUSION

It is the need of time to explore the unknown and uncommon medicinal properties of known ayurvedic herbs. On the basis of this study it can be concluded that *Kantakari* is a drug with good antimicrobial activity in lower urinary tract infection.

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