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VARIOUS DIAGNOSTIC METHODS OF URINARY TRACT INFECTION W.S.R TO AYURVEDA

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ABSTRACT

Urinary tract infection is one of the most common bacterial infection ranks among 3rd most widespread infection. The delay diagnosis & repeated antibiotic administration leads to development of resistance and recurrence, renal and hepatic dysfunction, hypertension, chronic renal failure, and renal scar. The knowledge of disease diagnosis and prognosis helps to select treatment regimens in order to ensure the permanent care. To begin with first vyadhi parikshan is done & then treatment is opted for. Ayurvedic literature has mentioned and elaborately explained the mutravah srotas dushti and diagnostic method which help in prevention & effective management of urinary tract infection because prevention is easier and cost effective comparative to medication. In this article, the diagnostic method of UTI by Ayurvedic text and modern text is reviewed.

Keywords: UTI, Mutravahsrotas, diagnostic methods.

INTRODUCTION

Acharya Sushruta describe the feature of a healthy person as Samadosha, samagni (digestive fire)and balance state of Dhatus, Malas and physiological processes, pleasant state of Atma, Indriya (sensory organs), Mana (mind) are important. Ayurveda is ancient science which is based on holistic approach of disease. It treats the patient as whole preliminary through of signs and symptoms of specific disease will help to eliminate disease initially before it occurs. The knowledge of disease diagnosis and prognosis helps to select treatment regimens in order to ensure the permanent care. Development of any vyadhi depends upon the Dosha –dushya samurchana. There are several methods of examination in Ayurveda Ashtavidh pariksha consist of Nadi, Mutra, Mala, Jivha, Shabda, Sparsha, Drik, Akruti. Urinary tract infection is

one of the most common bacterial infection ranks among 3rd most widespread infection.

The delay diagnosis & repeated antibiotic administration leads to development of resistance and recurrence, renal and hepatic dysfunction, hypertension, chronic renal failure, and renal scar. The knowledge of disease diagnosis and prognosis helps to select treatment regimens in order to ensure the permanent care.

UTI definition and pathophysiology: Urinary tract infection may be defined as the presence of pathogen (micro organism) in any part of the urinary system which leads to an infection .UTI generally characterized by dysuria, frequent and painful urination which brings discomfort and decrease the quantity of life.

Pathophysiology: Although the urinary tract is normally a sterile environment, pathogen agents can migrate to the urethra from the rectum or vagina. When bacteria, microbes, viruses, fungi and parasites get in to the Urinary tract and under any conditions find the chance to multiply in the urine, they can lead to UTIs. Majority of the invasions of the urinary system and UTIs are caused by bacteria and of them the most common bacterial species are among the enteric bacteria's. Escherichia Coli in particular (E. coli) has the headship (80 percent) of the most frequent causes of the UTIs."There are two major routes by which microbial pathogens can infect the urinary tract: ascending spread of fecal flora and hematogenous spread. The most common route of infection is migration of organisms from the perineum through the urethra to the bladder and then to the kidney. Around 95% of UTIs are thought to arise in this way."

Structural and functional abnormalities, metabolic disorders, impaired immunity system, catheters or tubes placed in urethra and bladder are other root causes which increase the chance of UTIs. Diabetes, enlarged prostate, Urinary retention, Bowel incontinence, kidney stones, staying still and pregnancy are conditions that categorized among this group and prevalence the UTIs.

Table 1: Most of the generally common etiological agents of UTIs are listed in the table below.

Pathogens	Bacterial species	Escherichia coli
		Coagulase-negative staphylococci
		Klebsiella species
		Proteus species
		Enterobacter species
		Morganella morganii
		Citrobacter species
		Pseudomonas species
		Neisseria gonorrhea(sexually transmitted)
		Chlamydia trachomatis(sexually transmitted)
		Enterococcus species
		Staphylococcus aureus
		Staphylococcus saprophyticus
	Candida species	Candida albicans
		Candida glabrata
		Candida tropicalis
		Candida parapsilosis

		Candida krusei
	virus	BK virus
		Adenovirus
		cytomegalovirus

Classification

Urinary tract infection classifies due to the anatomical location of the infection and the terms of severity and complexity of the condition. Table 1-3 gives more details about UTI classification.

Anatomical location	Lower UTI	Urethritis	Infection of urethra
		cystitis	Infection of bladder
	Upper UTI	pyelonephritis	Infection of kidney.
Severity and Complexity	Uncomplicated UTI	Lower tract infection without any structural metabolic or immunological predispositions.	
	Recurrent UTI	Relapse	Symptoms recur on cessation of treatment and the same organism is isolated
		Re infection	Anew causative organism isolated.

SPECIMEN COLLECTION, TRANSPORTATION, AND PROCESSING

- Specimen Collection

Most urine specimens are obtained from adult patients via the clean-catch midstream technique. This technique has the following advantages: it is neither invasive nor uncomfortable, it is simple and inexpensive, it can be performed in almost any clinical setting, cleaning of skin and mucous membranes adjacent to the urethral orifice before micturition, allowing the first part of the urine stream to pass into the toilet, and collecting urine for culture from the midstream. Although the clean-catch midstream method is accepted and used widely, the available evidence

- Specimen transportation.

Urine specimens are plated within 2 h after collection unless specimens have been refrigerated or kept in a preservative, Specimen processing. Routine urine cultures should be plated using calibrated loops for the semi quantitative method. This method has the advantage of providing information re- grading the number of cfu/mL, as well as providing isolated colonies for identification and susceptibility testing. The types of media used for routine cultures should be limited to blood agar and Mac Conkey's agar. Flora in specimens obtained from outpatients, it is not necessary to routinely inoculate a medium that is selective for gram-positive bacteria, because nearly all UTIs in outpatients are caused by aerobic and facultative gram- negative bacteria. Even in patient populations in which Staphylococcus saprophyticus is a common cause of UTI.

- NONCULTURE METHODS FOR THE LABORATORY DIAGNOSIS OF UTI

1 -Detection of bacteriuria by urine microscopy using,

Gram staining of un- centrifuged urine specimens

Gram staining of centrifuged specimens

Direct observation of bacteria in urine specimens.

METHOD -:

A volume of urine is applied to a glass microscope slide, Allowed to air dry, Stained with Gram stain, Examined microscopically.

The performance characteristics of the test are not well-defined, because different criteria have been used to define a positive test result. The urine Gram stain test has the important advantage of providing immediate information as to the nature of the infecting bacterium or yeast (rarely infectious agents such as microsporidia) and thereby guiding the physician in select in gem- picric antimicrobial therapy. This is of importance in some settings, but the

disadvantages: 1) It is an insensitive test, being reliably positive only if the concentration of bacteria in the urine is 105 cfu/mL; infections with bacterial concentrations of 102–103 cfu/mL may not be detected by this test.

2) The test is too labor intensive for it to be practical for most clinical microbiology laboratories to offer it on more than a select basis.

3) Because it may not detect bacteria at concentrations of 102–103 cfu/mL, it should not be used in the outpatient setting for patients with uncomplicated UTIs. Be- cause of these limitations, its use should be limited to patients with cases of acute pylonephritis, patients with invasive UTIs, or other patients for whom it is important to have immediate information as to the nature of the infecting pathogen.

2-Detection of bacteriuria by nitrite test. -:

Bacteriuria can be detected chemically when bacteria produce nitrite from nitrate .The biochemical reaction that is detected by the nitrite test is associated with members of the family Enterobacteriaceae (the pathogens most commonly responsible for UTIs)

Limitations –

Nitrite production is not associated with urinary-tract pathogens such as S.saprophyticus, Pseudomonas species, or enterococci.

It requires testing a specimen of the first urine produced in the morning, as 4 h are required for bacteria to convert nitrate to nitrite at levels that are reliably detectable.

3-Detection of pyuria by urine microscopy: Pyuria can be detected and quantified microscopically by measuring the urinary leukocyte excretion rate, counting leukocytes with a hemocytometer, counting leukocytes in urine specimens using Gram staining, or counting leukocytes in a centrifuged specimen.

Advantages - leukocyte casts, and other cellular elements are observed directly.

Disadvantage - leukocytes deteriorate quickly in urine that is not fresh or that has not been adequately preserved. In addition, Because of these disadvantages, urine microscopy should be limited to patients in whom pylonephritis or other more serious infections are suspected.

Patients with symptomatic UTIs have urinary leukocyte excretion rates of 400,000 leukocytes. The test is impractical for clinical use. The most practical microscopic method involves counting the number of leukocytes in the sediment of centrifuged urine specimens.

This method is inaccurate because of inadequate standardization of the method. For these reasons, and to facilitate the processing of large numbers of specimens, most laboratories use rapid tests for leukocyte esterase as a surrogate for microscopic leukocyte counts.

4-Detection of pyuria by leukocyte esterase tests-:

Leukocyte esterase tests are based on the hydrolysis of ester substrates by proteins with esterolytic activity. These proteins react with

ester substrates to produce alcohols and acids that then react with other chemicals to produce a color change that is proportional to the amount of esterase in the specimen.

Advantage: of detecting both esterase in intact leukocytes and esterase released after Cell lyses; therefore, even specimens that have not been preserved properly may yield a positive test result. Leukocyte esterase tests can yield false-positive test results when the urine is contaminated with bacteria present in vaginal fluid ;when the specimen contains eosinophils or Trichomonas species, both of which can act as sources of esterases; and when oxidizing agents or formalin react with the test strips to generate false-positive test results . Leukocyte esterase tests may show a decrease in positive test results when the specimen has an elevated specific gravity and/or elevated levels of protein and glucose; when boric acid preservatives are present; when large amounts of ascorbic or oxalic acid are present; and when the patient has received antimicrobial agents, such as cephalothin, cephalexin, or tetracycline. High concentration soft tetracycline may result in false-negative test results. When it is used alone, the leukocyte esterase test has a relatively low sensitivity and specificity and low positive predictive values as a test for UTIs, with higher negative predictive values.the studies. Nonetheless, the results are sufficiently consistent to allow some conclusions to be made.

Importance of non culture methods - :

First, the 2 tests, when used together, perform better than either test performs when used alone.

Second, the tests have better performance characteristics for detecting bacteriuria at high colony counts than at low colony counts

Third, these tests show low sensitivity, high specificity, low positive-predictive values, and high negative-predictive values. Taken together, the performance characteristics of these tests make them useful as a way to rule out bacteriuria on the basis of a negative test result.

A number of drugs can change the color of urine; abnormal urine color may affect urine tests that are based on the interpretation of color changes. In some cases, this can mask color changes, and in others, it may result in false-positive interpretations.

CULTURES AND THE LABORATORY DIAGNOSIS OF UTIs

Routine bacterial urine cultures: Urine culture may not be necessary as part of the evaluation of outpatients with uncomplicated UTIs. However, urine cultures are necessary for outpatients who have recurrent UTIs, experience treatment failures, or have complicated UTIs. Urine cultures are also necessary for inpatients who develop UTIs. The bacterial culture remains an important test in the diagnosis of UTI, not only because it helps to document infection, but also because it is necessary for determination of the identity of the infecting microorganism(s) and for antimicrobial susceptibility testing. This is particularly true because of the increased incidence of antimicrobial resistance. The most commonly used criterion for defining significant bacteriuria is the presence of 105 cfu per milliliter of urine. This criterion was established only for women with acute pylonephritis or women who were asymptomatic but had multiple urine cultures that yielded this number of bacteria; however, the criterion is often applied to other patient populations routine bacterial media. Interpretation of urine culture results?. Microbiologists need to interpret the microbiologic relevance of growth on culture plates to determine whether further identification and antimicrobial susceptibility testing are necessary. Most culture

results can be interpreted readily; no growth and gross contamination are both unambiguous results, as are pure cultures of common pathogens growing in a quantity of 1105 cfu per milliliter of urine. The interpretation of cultures that yield pure growth in lower quantities is also clear for specimens obtained via suprapubic aspiration or straight catheterization.

Requirement –

Dry sterile wide mouth leak proof bottle

First morning mid stream urine.

Precautions –

Male -: patient should wash the genital organs with water.

Female -: Should cleanse the area around the urethra opening with clean water and dry &urine should be collected with the labia held apart. Do not collect urine during menstrual period.

Infants-: urine collected in plastic bag with adherent mouth which is fixed around infants genitalia.

Laboratory Investigation -:

1-First Day -: Determination of colony count.

It is necessary to estimate the approximate number of bacteria in urine, since normal specimen may contain small number of organism .Investigation for the identification of the infectious organism are carried out when colony count is more than 1*1000000./ml.

Specimen analysis:

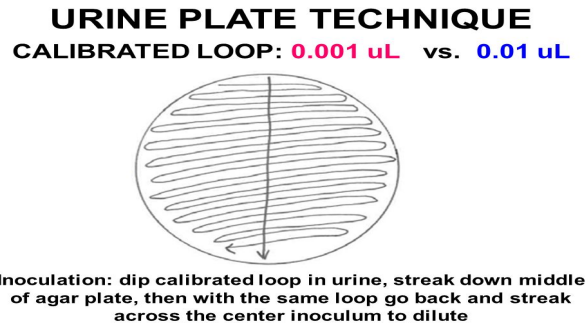
By staining method:-

1. Bacteria count /ml=no.of colony*100.
2. Centrifuge urine -) gram staining of sediment
3. Zeihl –Neelsen staining procedure if renal tuberculosis is suspected
4. Dark field preparation if leptospirosis is suspected..
5. Culture the specimen -blood agar

- Mac Conkey agar or EMB agar.
- Slenite broth if S typhi is suspected.
- LJ slopes if renal tuberculosis is suspected.

Procedure 2

1. Mix the specimen ,pick up aseptically one loop-full of urine by a standard nicrome loop
2. Place one loop-full organism on a blood agar plate for total count of all organism; and second on EMB or Mack –Conkey agar plate for total count of gram negative rods; as shown below.



1. Incubate plates under aerobic conditions at 37 degree Celsius for 18 to 24 hours.
2. Second day of culture:-

Examined the blood agar and Mack Conkey agar plates

Organism	Wet preparation	Gram Smear
E Coli	Motile Rods	Gram Negative.
Klebsiella stains	Non motile Rods or coccibacilli	Gram negative capsulated rods.
Proteus species	Motile rods	Gram negative rods.
Pseudomonas aeruginosa	Motile rods	Gram negative rods.
Enterococci	Cocci in Short chain or pairs	Gram positive.
Staphylococcus saprophyticus	Cocci (after attached to epithelial cells)	Gram positive Cocci.

Ayurvedokta Mutraparikshana:-

Diagnosis of Dosha in urine:

All the physiological and pathological function controlled by three Dosha (bio-humor). They also effect on urine. Ayurvedaacharyas has given some indications when any pathology occurs in the urine. Collected urine sample within the glass container, should be examine in bright light.

- Pandu Varniya (whitish), Nilam (bluish)and Ruksha due to Vata vitiation.
- Phenayukta, Snigdha due to Kapha vitiation.
- Raktavarniya (reddish), Peeta (yellowish), Arun and like oil due to Pitta vitiation.
- Mixed or as per predominate Dosha due to Dwandwaj Dosha vitiation
- Krushna (blackish) Varniya in Sannipataj state.
- Snigdha, Ushna and Raktavarniya (reddish) due to Rakta vitiation.

Abnormal urine color and its causes

Sr.no	Colour of Urine	Causes
1	Cloudy or milky (panduvarniy)	Urinary tract infection.
2	Milky urine(Arunvarna)	Bacteria. Crystal mucus in urine
3	Dark Brown but clear.	Liver Disorder ;acute viral hepatitis or cirrhosis
4	Pink Red or lighter brown	Hemolytic Anemia injury to the kidney or urinary tract
5	Dark Yellow or Orange (peet or Rakt varna)	B complex or carotene Rifampin and warfarin
6	Green or blue(neelvarna)	Artificial colors in foods or drugs ,excessive billirubi and urinary tract infection.

Tailbindu Parikshan:

Prognosis of disease by the examination of drop of oil on surface of the urin, The oil drop is placed on the surface of urine with help of Truna.

- Sadhya (curable) - if oil drop spreads gently and quickly on the surface of urine.
- Kashtasadhya- if oil drop does not spread over the surface of urine.
- Asadhya (incurable) - if the oil drop sinks to bottom of the container.

By the direction of the spread of oil drop

- Purva (East) - then the patient get relief and recovers health early.
- Dakshin (South)- then the patient will suffer from Jwara and recovers health gradually.
- Uttar (North)- then the patient will definitely be cured and will become healthy
- Paschim (West)- then the patient will get Sukha and Aarogya.
- Ishanya (Northeast)- then the patient is expected to be die in time of a month.
- Agneya (Southeast) and Nairutya (Southwest)-if the instilled oil drop splits, then the patient is bound to die.
- Vayavya (Northwest)- then the patient is going to die anyway.

By spreading shapes of the oil If the drop of oil spread on the surface of the urine, it creates the images of

- Hansa (swan), Chamara, lotus, Torana (arch), elephant, umbrella lotus then the prognosis is good.
- tortoise, buffalo shape, honey-bee like, headless human body, Shastra (instrument used in surgery, like knife etc), bird, Khanda

(piece of body material), arrow, resembles like three roads or 4e roads meeting each other, then physician should not treat that patient as that disease is incurable.

- Sieve shape of oil spread in patients suffering from Kulaj Dosha (incurable diseases).

By the shape of oil drop(21) Diagnosis of Dosha involvement

- Vataroga - If the shape of the oil drop takes image of Sarpa (snake like).
- Pittajaroga - If the shape of the oil drop takes an Umbrella shape.
- Kaphajaroga - If the oil drop spreads like Pearl (Mukta).

CONCLUSION

The proper knowledge about *Dosh Dushya* involvment, *samprapti and Sadhyasadhyatva of Vyadh*i (disease) can be diagnosed by assessing the patients. *Yogratnakar* explain the *Ashtavidhapariksha* for examination of patients of which *Mutrapariksha* is of them.

In urinary tract infection patient laboratory test are necessary to make the diagnosis and provide specific information regarding identify of the antimicrobial susceptible pattern of pathogen.

This article mainly focus on Urinary tract infection pathophysiology and classification, Specimen collection, transportation and various methods for diagnosis with advantages and limitation, Urine culture and *Ayurvedic Mutraparikshana.*

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