

A study of comorbidities, laboratory profile and the etiologies of urinary tract infection in elderly in a tertiary care hospital in north Karnataka

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Abstract

Background: Urinary tract infection and asymptomatic bacteriuria in elderly are commonly seen. In admitted geriatric patients, the risk of UTI is due to various characteristics such as anatomical and hormonal changes, and the presence of diabetes mellitus and neurological and urological abnormalities. UTI is many a times misdiagnosed because of non specific symptoms. Falls are often considered a reason for urine testing, but the association between falls and UTIs is controversial. In the absence of classic symptoms and positive urine cultures, there is often unnecessary prescription of antibiotic therapy. This study aims to find the risk factors, laboratory and etiological profile. **Methods:** This is a retrospective study, ninety seven cases of UTI in elderly admitted in General Medicine department at SDMCMSH,SDM university, Dharwad. UTI was diagnosed considering clinical features, blood, urine examinations and radiological evaluation. It is a retrospective, observational, non comparative, non randomized, analytical study. The descriptive statistical analysis was done. **Results:** Diabetes mellitus is the most common risk factor. Pyuria, leucocytosis, renal injury and raised C reactive proteins are noted. Gram negative organisms are the most causes. The radiological findings noted were prostatomegaly, pyelonephritis, renal or ureteric calculus, polycystic kidneys. **Conclusion:** UTI in elderly presents with typical or atypical features. A significant diagnostic difficulty exists in differentiating between ASB and UTI in older people. Multiple co morbidities and geriatric syndromes are commonly seen in such individuals. The diagnosis requires comprehensive work up rather than specific diagnostic tests. The treatment done after ruling out other possible source of infections, reduces the morbidity and mortality.

Keywords: Urine, Infection, Elderly

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Background

UTI is said to account for 30 to 40% of all health care associated infection, with an estimated point prevalence being 1.5% to 1.64%³. In community dwelling older adults, the UTI incidence and prevalence varies with age and gender^[1].

Urinary tract infections (UTI) are the important cause of infectious diseases among the elderly population. Females are more susceptible due to their anatomy and reproductive physiology^[2,3] Though, the ratio of UTI varies from geriatrics (50:1) to younger (2:1) population^[3]. Urinary tract infection [UTI] can involve lower or upper urinary tract, it is due to the multiplication of organisms in urine present in the bladder, urethra or kidneys. It can involve the lower or the upper urinary tract. Urinary tract infection is the second most common infection in the geriatric group. The atypical presentations of UTI in older adults may lead to delayed diagnosis, they are less likely to present with genitourinary symptoms. If not properly managed, it may lead to morbidity and mortality ^[1].

Establishing UTI in frail elderly individuals is challenging. UTI is diagnosed by urine culture, the mere presence of bacteriuria does not

constitute UTI. Asymptomatic bacteriuria (ASB) is defined as the presence of bacteria in the urine, without clinical signs or symptoms suggestive of a UTI^[4]. The prevalence of asymptomatic bacteriuria ranges from 25 to 50% in women and from 15 to 40% in men. ASB can co-exist with the presence of signs and symptoms that are often unrelated to UTIs^[2]. There is no reliable diagnosing test for diagnosing UTI^[8]. In 40% of hospitalized elderly, UTI are misdiagnosed due to the atypical presentations. Several studies reported that the primary cause of UTI was related to urinary incontinence, previous history, urogenital surgery and diabetes mellitus in specific patient populations^[3]. In elderly populations, there are concerns about increasing antimicrobial resistance in infecting organisms. The increased likelihood of resistant bacteria makes it essential that a urine specimen for culture and susceptibility testing be obtained before instituting antimicrobial therapy^[6].

Aims

To assess the comorbidities predisposing to UTI in elderly

To assess the laboratory features and organisms isolated in urine culture as an etiologic agent in UTI in elderly

Methods

The study is a descriptive analysis study conducted retrospectively at Sri Dharmasthala Manjunatheshwara College of Medical Sciences and Hospital, Sri Dharmasthala Manjunatheshwara University, Dharwad among 97 geriatric patients with urinary tract infection admitted under general medicine department. The study period was January 2019 to January 2020.

The inclusion criteria for our study were individuals more than 60 years with features of UTI.

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The diagnosis of UTI requires the following components and this was considered as a case of UTI in our study-

1. Fever, malaise, urinary frequency, dysuria, flank pain, suprapubic pain, or acute onset of non-specific symptoms which are not explained by any other source of infection.
2. Urine examination – pyuria, urine culture for bacteriuria. One or more of the following may also be considered:
 - _a. urine culture showing no more than one organism species
 - _b. pyuria (>10 white blood cells/cu mm/ high power field in microscopy)
 - _c. in catheter associated UTI - growth of $\geq 10^3$ colony forming units/mL of a urinary pathogen on urine culture
3. Systemic inflammation evidence like fever or hypothermia, raised WBC or CRP in blood.
4. The absence of another infection or non-infectious process to which the patient's symptoms can be readily attributed [10].

Results

The data collected from 97 patients, age more than 60 years.

Table 1: Gender Distribution

Males	49 [50.5%]
Females	48 [49.5%]

In our study male subjects were 49 and females 48.

Table 2: Co Morbidities

Diabetes mellitus	69%
Chronic kidney disease	19.5%
Ischemic heart disease	15.4%
Cerebrovascular accident	10.3%
Prostate hypertrophy	14.4%
Renal calculus	7.2%
Hypertension	58.7%

Our study noted diabetes mellitus as the most common co morbidity associated with UTI in elderly. The other common co morbidities observed were hypertension, ischemic heart disease, stroke, chronic kidney disease, ischemic heart disease, prostate related disorders and renal calculus. Other risk factors noted are hypothyroidism, chronic liver disease, Alzheimer, Parkinsonism and underlying malignancies [2 cases]. The chronic infections associated with UTI were Tuberculosis, HBV, HCV, HIV. Seventy four patients had two or more co morbidities.

Table 3: Total Leucocyte Count

More than 11000/cu mm	56
Less than 4000/ cu mm	4
4000 to 11000/cu mm	37

Leucocytosis was noted in 56 patients, leucopenia in 4 patients. Thirty seven patients had normal leucocyte count. Eight patients were having total counts more than 20,000. Total counts 15,000 were noted in 20 patients.

Table 4: Serum Creatinine

More than or equal to 1.4mg %	51
Less than 1.4 mg%	46

Our study noted serum creatinine more than 1.4 mg% in 51 patients. Thirty six patients had serum creatinine of more than 2mg%. Twelve patients were having creatinine more than 4 mg %. The most common urine routine finding noted was pus 10 to 15 per high power field, followed by plenty of pus cells. Thirty eight patients had urine pus cells 5 to 10 per high power field. Fifty nine patients were having blood C reactive protein more than 50mg%, the levels of procalcitonin were significantly high in ten patients. Seventeen patients were having glycosylated hemoglobin levels 6.5 to 8 %, thirty six had levels more than 8 %.

Table 5: Urine Culture Growth

E.coli	32
Klebsiella	6
Pseudomonas	4
Candida	4
ASB	2
Enterococcus	6
Fusarium	1
Citrobacter	1
Multiple organisms	4
No growth	37

Our study observed E.coli as the most common organism for UTI, Klebsiella and Enterococcus in 6 patients each, Pseudomonas, Candida and multiple organisms growth was seen in 4 cases each. Asymptomatic bacteriuria, Fusarium, Citrobacter were seen 2, 1, 1 patients respectively. Thirty seven patients urine culture did not show

The collected data of all individuals included patient demographic details age, sex, occupation, the comorbidities. The relevant history was taken and clinical examination done. The laboratory details of urine examination, renal function test, blood count, urine culture, imaging of abdomen and pelvis are collected.

The exclusion criterion was an elderly individual more than 60 years with other possible source of infection in patients with fever, systemic inflammation features and absence of typical urinary infection features.

The descriptive statistical study was conducted.

The laboratory testing methods were: Total leucocyte count done by automated method, CRP by nephelometry, procalcitonin by chemiluminescence immunoassay, urine routine by dipstick method, HbA1c by HPLC BIOCARD D10, RFT by alkaline dicrate kinetic IRCC-IDMS standardized and urine culture and sensitivity by CLED, McConkey agar (selective media).

any growth. Ultrasonography and CT scan of the abdomen and pelvis observed 15 patients had prostatomegaly, nine patients had hydro ureteronephrosis, pyelonephritis was noted in thirteen patients. Ten patients had cystitis, seven patients had renal calculus, and one had abdominal tuberculosis, one polycystic kidney disease.

Discussion

The evaluation of UTI in geriatric patients can be challenging due to faulty information, poor functional status and the presence of chronic lower urinary tract symptoms. Although non-specific changes in the clinical status of older patients such as delirium, increased falls, fatigue or loss of appetite, are frequently attributed to UTI, particularly in the presence of a positive urine culture, the value of these symptoms as indicators of UTI has been questioned[5]. A characteristic feature elderly is multiple comorbidities and high prevalence incontinence, dementia, malnutrition, falls, and depression [geriatric syndromes]. All these conditions can make older people more prone to urinary tract infections[7]. There is also inter-observer variability in noting patient’s mental state changes, particularly among aged care staff. Falls are often considered a reason for urine testing in nursing home residents, but the association between falls and UTIs is controversial[10]. Due to physiological variations, urinary tract infections are one of the most common infections in geriatrics. The chances of UTI are higher in the presence of chronic diseases like diabetes, HTN, cognitive impairments etc. it can even sometimes lead to mortality[3]. A single evidence-based approach to diagnosis of urinary tract infection does not exist[4]. Although a weak association, increasing age is a risk factor for UTI. Ageing disrupts acquired immunity due to T cell dysfunction and blunted cytokine-mediated inflammatory response[10]. Our study shows males (50.5%) are more commonly affected than females (49.5%). The results of Gaurav et al study showed that UTI was more common among males (52.8%) than females (47.2%). The results were similar in the studies done by Faryabi et al., Mahesh et al. Arul Prakasam et al. However the study by Prakash and Saxena found that UTI was more common in females (73.57%) rather than males (35.14%). Pranita K study noted males affected in 55.78% [12]. Our study noted diabetes mellitus (69%) as the most common risk factor for UTI. A study by Sanmita Ram et al noted DM in 42 cases, Swamy S et al noted DM in 63.3%, Gaurav et al noted 64.1% were diabetics, Pragati et al noted DM in 37%, Marques et al. Study observed 23.52% had DM-UTI and in Mahesh et al. study, around 42.6% of the cases have a history of diabetes mellitus [1,3,6]. Diabetes mellitus and its long-term complications is a major co morbid factor which increases the mortality and morbidity in urosepsis patients in elderly. Strict

glycemic control and monitoring is required to curb the severe extent of spectrum of urinary tract infection[6]. A study by Swamy S et al states, longer duration and severity of diabetes was also noted as a risk factor for UTI [6]. Pranita K et al also noted diabetes mellitus as most common risk factor [12]. Our study noted prostate related risk factors in 14.4% and renal/ ureter calculus in 7.2%. A study by Sanmita Ram et al noted BPH in 11, obstructive uropathy in 8, calculus in 5 cases [1]. A study by Swamy S et al BPH in 23.8% [6]. The other study by Smithson et al et al noted prostate related problems as a risk factor in 57 % cases [5]. Y Alpaya et al noted 41.4% of UTI had urological problems [15]. In patients with chronic renal insufficiency (or CKD), the risk might be increased by disease factors (papillary necrosis, nephrolithiasis, neurogenic bladder) and the management of comorbidities with Foley catheters and intravenous lines [6]. Our study noted CKD in 19.5% cases, studies by Smithson et al and Swamy S et al noted CKD in 14.9% and 21.6% respectively [5,6]. Zyta BW study says various chronic diseases and conditions that could predispose to urinary tract infections, such as impairment in activities of daily living, cognitive impairment/dementia, diabetes, prostatic hypertrophy in men, urinary incontinence, and chronic use of urinary catheter were very common in the studied group [7]. Our study noted stroke as a risk factor in 10.3% patients, a study by Swamy S et al noted stroke as a risk factor in 14.1% cases [6]. Dementia was noted in 0.9% and 1.6% cases by Smithson et al and Swamy S et al respectively [5,6]. Our study also noted dementia as an associated risk factor in comparison with the other studies. A study by Jung et al reports 88% publications have positive association between UTI and neuropsychological disorders, 47% clinical cases of neuropsychological disorders is precipitated or exaggerated by UTI. The study noted a prevalence of UTI with delirium in 19.4%, dementia in 11.2%, 21.7% in non affective psychological disorders, 17.8% in mood disorders [13]. LC Yourman et al study says people with dementia had two odds of being diagnosed with UTI in emergency medicine department compared to those without dementia despite their lower prevalence of symptoms or signs localizing to the genitourinary tract [14]. Y Alpaya et al noted neurological problems in 19.2% [15]. Immunosuppressed state was noted 2.1% and 1.3% by Smithson et al and Swamy S et al respectively [5,6] this finding was similar in our study.

Table 6: Risk Factors for UTI in Older Adults

Risk Factors	Proposed Mechanism
Diabetes, autoimmune disease, cancer	Impaired cellular function
Dementia, Cerebrovascular events, Parkinsonism	Bladder and bowel incontinence ,altered functional status
Oestrogen deficiency/ post menopause	Ascending flow of bacteria into sterile urinary tract as a result of vaginal prolapse, vaginal atrophy and urinary incontinence
Prostate hypertrophy	Urinary retention and turbulent urine flow may cause chronic prostatitis
Urinary catheter or stone or sutures or surgical material	Disruption of defense mechanisms, granting bacteria easier access to the bladder [catheter surface colonization by bacteria – biofilm] Catheter block obstructs the urine flow, leads to urine stagnation and bacterial multiplication
Sexual activity / practices	Most notable risk factor in older males and females

A study by Smithson et al noted WBC count 13,348 +/- 5536, our study noted leucocytosis of more than 11000 in 54 cases [55.6%] and leucopenia in 4 cases [4.12%] [5]. Leucocytosis, as defined by leukocyte count >12,000/cu mm, was present in 13 (30.2%) patients in the bacteriuric group and 7 (12.3%) patients in the non-bacteriuric group [9]. We noted serum creatinine more than 1.4mg% in 51 cases, similar findings were noted from Swamy S et al and Smithson et al studies [5,6]. A Smithson et al noted WBC in the range of 6-9 G/L, CRP 3.2 to 13.9 mg/L and serum creatinine 81 to 122 micromol/L [5]. Our study noted raised CRP in 60.8% cases, Y Alpaya et al reported CRP values of 84 mg/L and leukocyte counts of 11900/cu mm [15]. Sepsis was noted in 12 patients [3.6%] by Smithson et al, our study noted raised procalcitonin in ten patients and 28 patients were having features of sepsis [raised CRP and total counts more than 20,000] The study Sadhna Sharma et al evaluation of fasting blood glucose level more than 126mg%, noted that 100% patients were in the

bacteriuric group and 93% patients in the non-bacteriuric group, while 100% patients in the bacteriuric group had HbA1c levels >7% as compared 94.7% patients in the non-bacteriuric group. However, 86.0% and 68.5% patients in the bacteriuric and non-bacteriuric groups had HbA1c levels >10% respectively [9]. In our study 36 patients had HbA1c more than 8% in 36 cases, a study by Vaishav B et al., noted higher incidence of bacteriuria in patients with uncontrolled diabetes mellitus, while Sewify M et al. study showed no association between control of diabetes and incidence of bacteriuria. In Sadna Sharma et al study, laboratory investigations revealed uncontrolled fasting blood sugar levels and high HbA1c levels in both group of patients [9]. Our study noted E.coli as the most common organism for UTI. Sanmitha Ram et al study noted same results as most of the previous studies did, E. coli being the most common organism causing UTI. The other organisms are Proteus, Candida, Pseudomonas, Klebsiella. According to Artero et al, E. coli was

initially associated with a higher proportion of bacteremia with its independent risk factors being temperature >38 degree C and heart rate >90 bpm[1]. Zyta BW study noted *E.coli* in 73%, followed by *Klebsiella* and *Proteus*[7]. *E.coli* is the most common causative organism in younger and older adults. Other coliforms (Gram-negative organisms found in the intestine, eg. *klebsiella*, *proteus* and *enterobacter*) are also frequently detected. However, Gram-positive (eg *enterococci*) and atypical organisms (eg *pseudomonas*) account for a larger proportion of UTIs in older people[8]. A study by Sadhna Sharma et al on urine cultures report for the most common causative organisms of bacteriuria revealed that the most common bacteria isolated was *E. coli*, followed by *Klebsiella spp.*, *Enterococci*, *Pseudomonas*, *Candida*. Gender based evaluation also showed *E. coli* as the most common causative organism in both males and females[9]. Gram negative bacteria were isolated in 92.63% cases in Pranit K et al study, 47.36% among these were due to *E.coli*, followed by *Pseudomonas* and *Klebsiella*[12]. *E.coli* and *Klebsiella* were noted as most common organisms in UTI by Y Alpaya et al study[15]. The reasons for obtaining urine culture are – confirming UTI, recurrent UTI, determine resistance, indecisive dipstick results, severely ill patients, on request by patient or caregivers[2]. A study by Sadhna Sharma et al ultrasound examination in elderly diabetic patients with and without bacteriuria - post-voidal residue did not show any statistically significant difference between bacteriuric and non-bacteriuric patients. Ultrasound abdomen of all patients revealed BPH in 12.3% patients in the non-bacteriuric group and 4.7% patients in the bacteriuric group. In addition, 12 cases of pyelonephritis and eight cases of cystitis were noted in the bacteriuric group of patients[9]. Our study noted prostatomegaly [15.4%], cystitis [10.3%], pyelonephritis [13.4%], renal calculus [7.2%], hydronephrosis [9.2%] small kidneys/ renal parenchymal changes [18.5%], polycystic kidneys [1.03%], abdominal tuberculosis [1.03%]. One patient had emphysematous pyelonephritis, one had hepatosplenomegaly, one had features of chronic liver disease with portal hypertension, one patient had renal abscess, one patient had urinary bladder hematoma, one had stag horn calculus. The remaining had normal imaging studies [20.6%]. Pranit K et al study noted increase in mortality in diabetes mellitus, dementia and creatinine more than 1.4mg%, the mortality rate was not more in those with urinary catheterization and leukocytosis[12]. In older adults, the rate of ASB is so high that bacteriuria cannot be considered an abnormal finding. Our study noted ASB 2.06% cases. A study shows females with urinary incontinence have higher prevalence of ASB, hence vague symptoms and positive urine cultures should be interpreted with care before antibiotics use[11]. Imaging of the urinary tract should be considered for patients who do not improve with 48-72 hours of antibiotics, in those with history renal and/or ureteric calculi, ureter stents in situ and in those who have a decline in kidney functions from the baseline. Ultrasound of the urinary system is safe, non-invasive and generally provides the clinical information required. Some patients who present acutely may need CT scan. CT scans can identify renal calculi, pyelonephritis, haemorrhage or renal cortical abscess. Chronic obstruction or urinary incontinence may require specialized studies such as CT intravenous pyelography and urodynamic evaluation of the bladder[10]. The use of biomarkers in UTI diagnosis can be of help, especially in nursing home settings. Interleukins 8, IL-6, lactoferrin and procalcitonin are used in children and postoperatively in young adults. However, the evidence supporting accuracy of these markers is moderate and further research is needed in older adults[10].

The drawbacks of our study are it is retrospective, antibiotic sensitivity pattern is not considered and details of urinary catheterization of the subjects involved are not mentioned.

Conflict of Interest: Nil

Source of support: Nil

Conclusion

UTI can present with symptoms of typical urinary tract involvement or it can present with atypical manifestations. It needs comprehensive assessment rather than a specific diagnostic tests.

Multiple co morbidities is a risk factor for UTI and its complications in the elderly. Urinary catheters should be used only if absolutely necessary and removed as early as possible. A significant diagnostic difficulty exists in differentiating between ASB and UTI in older people. In cases of delirium with bacteriuria, without UTI symptoms or systemic inflammation such as fever, hemodynamic instability, other causes of delirium should be evaluated and patient needs to be observed before treating as UTI. Urine culture in elderly needs to be advised in the two situations, first in cases of acute urinary symptoms typical of UTI and to confirm antibiotic susceptibility pattern. Second in cases of no UTI symptoms but features suggestive of systemic inflammation and no other likely source of acute illness. ASB in elderly need not be treated, appropriate narrow spectrum antibiotics for shortest effective duration results in recovery and minimizes morbidity and mortality. It reduces the antibiotic resistance and adverse effects. It helps in addressing the polypharmacy issues.

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