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A study on microbiological profile of complicated Urinary Tract Infection (UTI) in a tertiary care hospital of NE region

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Abstract

Introduction: Complicated Urinary Tract Infection (UTI) occurs in patients with structural or functional abnormalities in the genitor-urinary tract. Each patient should be assessed carefully to ensure a correct diagnosis so that anti-microbial therapy is appropriately prescribed for symptomatic patients to decrease the morbidity and avoided for most asymptomatic patients.

Objectives

1. To evaluate the bacteriological profile of patients with complicated UTI
2. To ascertain the associated risk factors.

Materials and Methods: The study included 1069 patients (869 from Nephrology, Urology and Endocrinology and 200 from ICU). The urine samples were processed by culturing on Blood agar and MacConkey agar. Antibiotic susceptibility of the isolates were tested using the Modified Kirby-Bauer disc diffusion method as per CLSI recommendations.

Results: Bacterial pathogens were isolated from 556 (52.01%) cases. Insignificant growth and No growth were observed in 513 (47.98%) individuals. Escherichia coli (33.81%) was the most common etiological agent followed by Budding Yeast (19.78%), Pseudomonas aeruginosa (7.91%) and Staphylococcus aureus (5.93%). Imipenem was found to be the most susceptible against Enterobacteriaceae (100%) and Pseudomonas aeruginosa (100%). Vancomycin and Linezolid (100%) followed by Teicoplanin (96.4%) were the most sensitive agents for Staphylococcus aureus. 22.3% of the Staphylococcus aureus isolates were Methicillin resistant. Budding yeast (61.74%) was the most commonly isolated etiological agent in ICU patients.

Conclusion: The study highlights the importance of structural and functional abnormalities of the Genito-Urinary tract in the pathogenesis of complicated UTI. Urine culture and antibiotic susceptibility tests provided useful information in choosing effective and prompt therapy against bacterial pathogens and cure of infected cases.

Keywords: Genito-Urinary, Complicated, Abnormalities, Northeast, Infection.

Introduction

Urinary tract infections (UTIs) are one of the most common bacterial infections that encountered by medical clininicians in developing countries and lead patients to seek medical care. Annual global incidence of UTI has been estimated at least 250 million [1, 2]. Also it has been estimated that globally symptomatic UTIs result in as many as 7 million visits to outpatient clinics, 1 million visits to emergency departments, and 100,000 hospitalizations annually [3]. UTIs refer to the presence of microbial pathogens within the urinary tract and it is usually classified by the infection site:- bladder [cystitis], kidney [pyelonephritis], or urine [bacteriuria] and also can be asymptomatic or symptomatic, UTIs that occur in a normal genitourinary tract with no prior instrumentation are considered as "uncomplicated," whereas "complicated" infections are diagnosed in genitourinary tracts that have structural or functional abnormalities, including instrumentation such as indwelling urethral catheters, obstruction like stone, underlying diseases that predispose the kidney to infection like diabetes and are frequently asymptomatic [4,5] In the past few years, the number of complicated UTI due to resistant gram-negative bacteria has risen, mainly due to spread of multidrug resistant bacteria which pose a significant therapeutic challenge. Although a broad range of pathogens can cause complicated UTI, Escherichia coli remain the most common.[6] Complicated urinary tract infection (UTI) occurs in patients· with a genitourinary tract that does not function normally, usually due to structural or functional abnormalities. There are a wide variety of diseases and interventions responsible for complicated UTI, including obstructive lesions, metabolic diseases, instrumentation, foreign bodies, or dysfunctional voiding primarily due to neurologic illnesses. The wide variation in abnormalities means there is substantial variation in the clinical characteristics of UTI in these different populations. For instance, in some patients with a nonfunctioning kidney, once infection is established, it usually cannot be eradicated, and relapsing infection with the same organism will persist. Another group of patients, those with neurogenic bladder and voiding managed by intermittent catheterization, have a high incidence of infection with new infecting organisms, which are constantly introduced into the urinary tract. In other instances, such as infection associated

with obstruction when a stone is passed, correction of the abnormality (i.e., removal of the stone) will alleviate the complicating factor, and further infection is unlikely to occur. This great diversity in risk factors and natural history must be appreciated in any discussion of complicated UTI [7]. Each patient should be assessed carefully to ensure a correct diagnosis so that anti-microbial therapy is appropriately prescribed for symptomatic patients to decrease the morbidity and avoided for most asymptomatic patients Urine culture is useful, as a negative urine culture has a high negative predictive value to exclude urinary infection.

Aims and Objectives

3. To evaluate the bacteriological profile of patients with complicated UTI
4. To ascertain the associated risk factors.

Materials and Methods: The study included a total of 1069 (One thousand and sixty nine) patients from Nephrology, Urology, Endocrinology wards (Diabetic patients) and GICU of Gauhati Medical College and Hospital from May 2013 to July 2013 [Fig 1]. Majority of the samples were midstream urine specimens, and others included catheterized urine samples and supra pubic aspirates. Culture was done in the bacteriology section of Department of Microbiology, Gauhati Medical College by the calibrated loop technique delivering 0.001 mL of urine and plated on Blood Agar and MacConkey Agar plates.

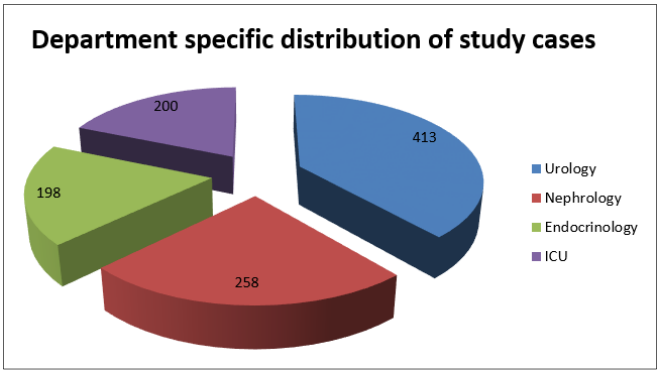


Fig 1: Department specific distribution of study cases

For gram-negative bacilli, more than 10^5 colonies per mL of urine, whereas for gram positive cocci 10^3-10^5 colonies per mL was considered significant.[4, 5] The colonies were identified by standard biochemical tests and sensitivity of the organisms was performed by Modified Kirby Bauer disk diffusion method on Mueller Hinton agar plates. [6]. The antibiotic discs and their concentrations per disc (mg) included: Ampicillin (10), Cotrimoxazole (25), Nitrofurantoin (300), Doxycycline (30), Gentamicin (10), Amikacin (30), Ciprofloxacin (5); various cephalosporins such as Cefuroxime (30), Cefotaxime (30), Ceftazidime (30), Piperacillin-tazobactum (100), Imipenem (10), Polymixin B (300), Vancomycin (30), Linezolid (30) and Teicoplanin (30). The source of Mueller Hinton Agar (MHA) and antibiotic discs was Hi Media, India.

Results

Bacterial pathogens were isolated from 556 (52.01%) cases. Insignificant growth and no growth were found in 513 (47.98%) individuals. The rate of isolation was found to be maximum in ICU, 149 out of 200 (74.5%) followed by Urology, 292 out of 413(70.70%) [Fig 2]

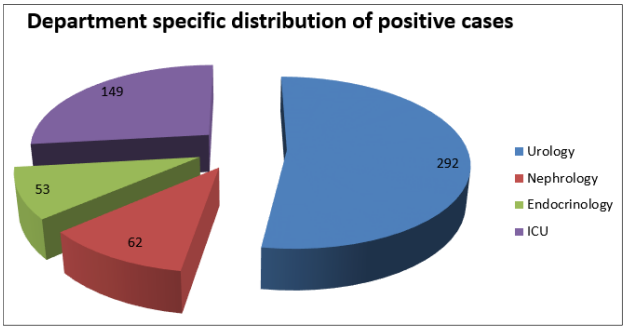


Fig 2: Department specific distribution of positive cases

Escherichia coli (33.81%) was the most common etiological agent followed by Budding yeast(19.78%), Klebsiella(16.91%), Enterococcus spp(11.15%), Pseudomonas aeruginosa (7.91%), Staphylococcus aureus(5.93%) and Coagulase Negative Staphylococcal spp (CONS)[Fig 3,4,5,6]. However, amongst the isolates from ICU, Budding yeast was the commonest organism followed by Enterococci [Fig 7].

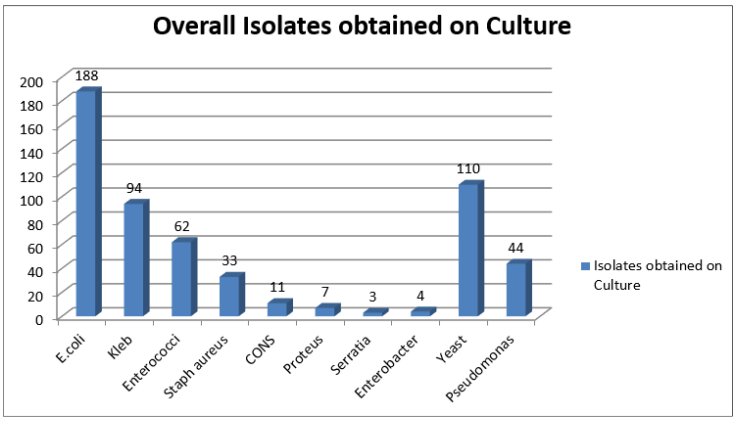


Fig 3: Overall Isolates obtained on urine culture

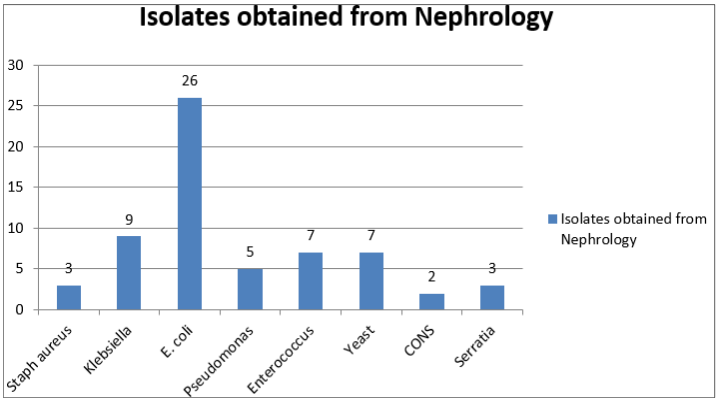


Fig 4: Isolates obtained from Nephrology

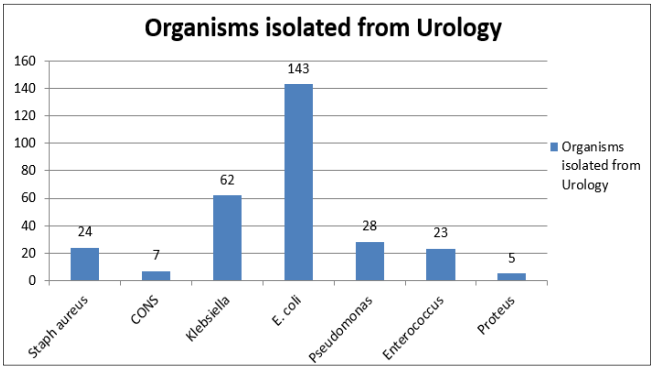


Fig 5: Isolates obtained from Urology

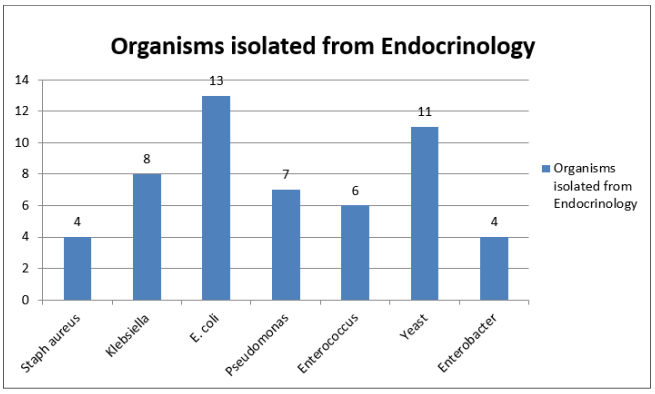


Fig 6: Isolates obtained from Endocrinology

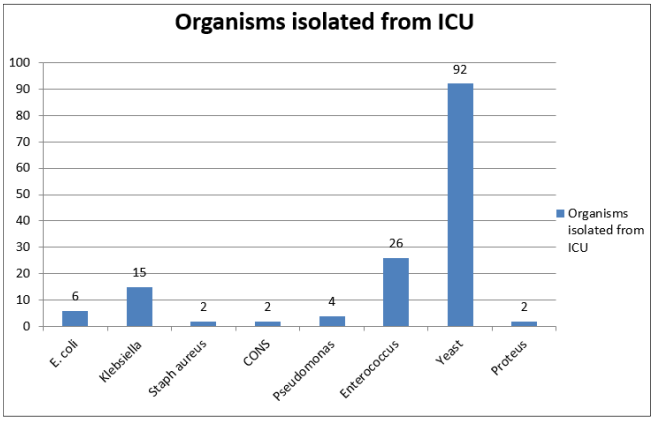


Fig 7: Isolates obtained from ICU

Imipenem and Polymixin B were found to be most susceptible against Enterobacteriaceae (100%) and Pseudomonas aeruginosa (100%) [Table 1, Fig 8]. Vancomycin and Linezolid (100%) followed by Teicoplanin (95.8%) were the most sensitive agents for the Gram positive isolates. [Table 2, Fig 9]. 23.48% of Staphylococcus aureus were Methicillin resistant. Budding yeast (61.74%) was the most commonly isolated etiological agent in ICU patients.

Table 1: Antibiotic susceptibility pattern of Gram negative isolates

Antibiotic	% Sensitive*	% Resistant*
Nitrofurantoin	89%	11%
Ciprofloxacin	73%	27%
Cotrimoxazole	71%	29%
Amikacin/Gentamicin	56%	44%
Cefotaxime	31%	69%
Piperacillin-Tazobactum	77%	23%
Imipenem	100%	0%
Polymixin B	100%	0%

*Figures rounded up

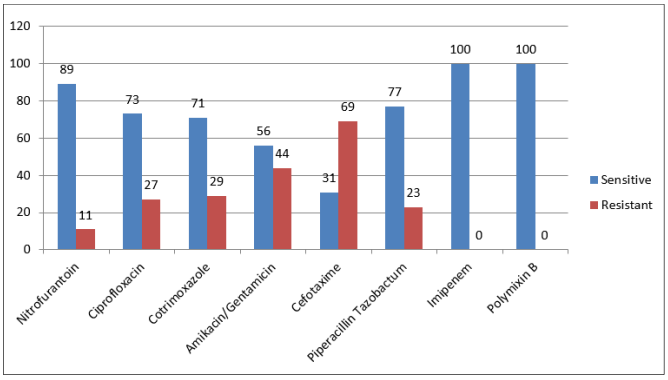
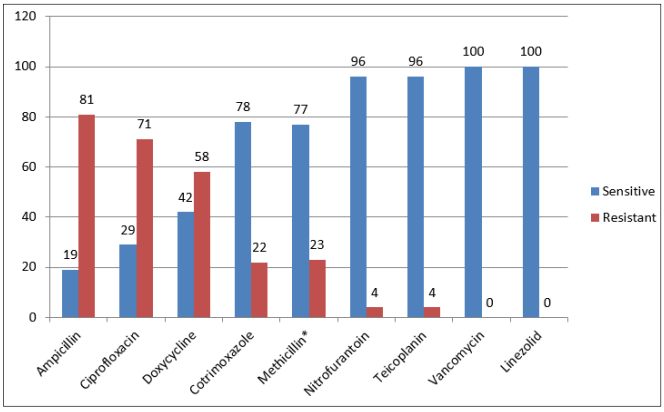


Fig 8: Antibiotic susceptibility pattern of Gram negative isolates

Table 2: Antibiotic susceptibility pattern of Gram positive isolates

Antibiotic	% Sensitive*	% Resistant*
Ampicillin	19%	81%
Ciprofloxacin	29%	71%
Doxycycline	42%	58%
Cotrimoxazole	78%	22%
Methicillin	77%	23%
Nitrofurantoin	96%	4%
Teicoplanin	96%	4%
Vancomycin	100%	0%
Linezolid	100%	0%

***Figures rounded up**



* Methicillin sensitivity is meant only for the staphylococcus aureus

Fig 9: Antibiotic susceptibility pattern of Gram positive isolates

Discussion

Complicated UTI is a heterogeneous clinical entity with a wide variation in underlying abnormalities that promote infection and in infecting organisms. In our study, *E. coli* was the most common isolate (34.67%). This is similar to studies from other tertiary care centers. [7, 8, 9] *E. coli* strains isolated from complicated UTI cases are, as a group, less virulent that those isolated from uncomplicated infections. There is still, however, a spectrum of virulence characteristics among strains isolated from complicated UTI cases, and the clinical meaning of this variation is not well understood.

S. aureus is another organism of significant virulence, especially the ones with methicillin resistance (MRSA). Organisms such as CONS and Enterococci are generally recognized to be of low pathogenic potential but may cause UTI in subjects with an abnormal genitourinary tract. They may be less likely, however, to cause invasive UTI, and are consistently associated with a lower degree of inflammatory response in the urinary tract. Another important observation in our study is that pathogenic CONS is isolated from patients admitted in Urology, Nephrology and ICU but not in Endocrinology wards. This emphasizes the importance of instrumentation as a mode of entry or rather pathogenic mechanism for the expression of virulence of these organisms.

Likewise, it is also observed that *Proteus* spp have been isolated from patients admitted in Urology wards, who are likely to be suffering from anatomical dysfunctions like renal stones in the urinary tract. This reiterates the fact that infection by certain organisms is more likely in complicated UTI as compared to uncomplicated UTI. Correcting the underlying genitourinary abnormality responsible for infection is paramount in the management of complicated UTI. If it can be achieved, this is the most useful intervention to prevent further infections [10]. While the impact of the organism is less important in establishing infection in complicated than uncomplicated UTI, organism variables are likely relevant in determining whether infection is symptomatic and whether infection will persist [10]. A better understanding of organism variables may lead to creative strategies to assist in managing the difficult problem of complicated UTI.

The study highlighted the importance of structural and functional abnormalities of the Genito-urinary tract in the pathogenesis of complicated UTI. Urine culture and antibiotic susceptibility tests provided useful information in choosing effective and prompt therapy against bacterial pathogens and cure of infected cases.

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