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A Study on the Bacteriological Profile of Uncomplicated Urinary Tract Infections in a Tertiary Care Hospital, K.A.P.V. Govt. Medical College, Trichy, India

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A B S T R A C T

This study was conducted to identify and isolate the bacterial pathogens causing uncomplicated urinary tract infections and their antimicrobial susceptibility patterns in a tertiary care hospital, Trichy. Clean catch midstream urine samples were collected from symptomatic patients and cultured under aerobic conditions on Cysteine Lactose Electrolyte Deficient (CLED) agar. Samples having significant growth (>10^5 cfu /ml) and significant number of pus cells in direct smear were processed further by standard microbiological techniques. Antimicrobial susceptibility pattern was evaluated by Kirby – Bauer disk diffusion method according to CLSI guidelines. Out of 3408 urine samples processed, 663 samples showed significant growth on culture. The prevalence of UTI in study population was 20%. *Escherichia coli* was the commonest isolate (59.8%), *Klebsiella spp* (18%), *Enterococcus spp* (15%), *Acinetobacter baumanni* (4%), *Pseudomonas aeruginosa* (3%), *Proteus spp* (0.75%). Among these isolates gram negative bacilli showed high susceptibility to Nitrofurantoin, Cotrimoxazole and gram positive organisms to Nitrofurantoin and Ampicillin. This study has shown Nitrofurantoin, Cotrimoxazole and Ampicillin are the most effective drugs for the empirical therapy of UTI in our region. The study of antimicrobial susceptibility pattern of organisms causing UTI in particular area can help the clinicians to choose the antibiotic so that misuse of antibiotics can be prevented.

Introduction

Urinary tract infections remains one of the most common infections and a leading cause of morbidity in human population. Uncomplicated urinary tract infections occur in patients with no structural abnormality or comorbidities such as diabetes, old age, pregnancy, or immunocompromised status. Complicated urinary tract infections occur in patients with structural abnormalities or comorbidities such as diabetes, old age, pregnancy, or immunocompromised status. Uncomplicated UTI is also known as cystitis or lower UTI.

Bacteriuria alone does not constitute a UTI without symptoms. Typical symptoms include urinary frequency, urgency, suprapubic discomfort and dysuria (Michael J. Bono *et al.,* 2023).

Urinary tract infections occur at least four times more frequently in females than males. Many cases of uncomplicated UTIs will resolve spontaneously, without treatment, but many patients seek therapy for symptom relief. Treatment is aimed at preventing the spread to the kidneys or developing into upper tract disease/pyelonephritis, which can cause the destruction

of the delicate structures in the nephrons and eventually lead to hypertension (Lisa K. McLellan and David A. Hunstad, 2016; Anonymous, 2018; Long and Koyfman, 2018; Oscar Storme, *et al.,* 2019; Tang *et al.,* 2019).

Several risk factors are associated with cystitis including female gender, sexual activity, prior UTI, obesity and genetic susceptibility. UTIs are caused by Gram positive bacteria, Gram negative bacteria and certain fungi. Patients suffering from UTI are treated with antibiotics which may lead to long-term alteration in the normal microbial flora and in the development of multidrug resistant organisms (Ana L. Flores-Mireles *et al.,* 2015). Hence this study was undertaken to isolate the urinary pathogens and to determine their antimicrobial susceptibility patterns.

Materials and Methods

This study was conducted at the Department of Microbiology, K.A.P.V.Govt medical college, Trichy for a period of 6 months after getting clearance from the Institutional Ethics Committee.

Study Population

3408 Urine samples were collected from suspected cases of UTI. This included all patients (outpatients and inpatients) irrespective of their age, gender with UTI symptoms such as burning micturition, fever, dysuria, haematuria etc.

Sample Collection

Sterile, wide mouthed, leak proof, screw capped containers were given to patients and they were instructed to give early morning clean catch midstream urine samples. The collected urine samples were labelled legibly with all the patient particulars and sent to the lab with requisition forms. The samples were processed according to the standard protocol within 2 hours of collection.

Processing of Samples

Urine samples were cultured using sterile calibrated bacteriological loop measuring 4 mm that delivers 0.01ml of urine. Urine sample was mixed well and a loopful of urine was inoculated onto Cysteine Lactose Electrolyte Deficient (CLED) agar plate. The plates were incubated at 37*C for 18 to 24 hours.

After incubation the plates were examined for the bacterial growth. The colony count was done using semiquantitative method and was multiplied by 100 to give a measure of number of colony forming units (CFU) present per ml of urine.

A count of equal to or more than 10^5 CFU per ml was taken as significant growth. Samples showing significant growth and more than or equal to one pus cells per oil immersion field in direct smear are processed further.

Samples showing less than 10^5 CFU per ml and pus cells less than one per oil immersion field were considered as insignificant and not processed further. From samples showing mixed growth, repeat early morning fresh midstream urine samples were collected and processed.

Isolated bacterial pathogens were identified based on Gram staining, morphological characteristics and biochemical reactions by standard microbiological techniques. Antimicrobial susceptibility testing was performed using Kirby – Bauer disk diffusion method as per the latest Clinical and Laboratory Standards Institute (CLSI) guidelines. The Mueller – Hinton agar (MHA) plates were incubated for 18 to 24 hours and the results were interpreted on the next day.

Results and Discussion

Out of the 3408 urine samples processed, 2745 (80%) samples showed no growth or insignificant growth, 663 (20%) samples significant growth on culture. The prevalence of UTI in study population was 20%.

Out of the 663 samples that showed significant growth, *Escherichia coli* was the commonest isolate (59.8%), followed by *Enterococcus spp* (15%), *Klebsiella spp* (15%), *Acinetobacter baumannii* (4%), *Pseudomonas aeruginosa* (3%), *Proteus spp* (0.75%).

The prevalence of UTI in the study population was 20 % which corresponds to the study conducted by Martha Medina *et al.,* (2019) (20%). The most common pathogens isolated were *E.coli* (59.8%), *Klebsiella* (15%) and *Enterococcus spp* (15%) which correlates with the study done by Ana L. Flores - Mireles *et al.,* (2015).

Table.1 Sample distribution

Gender	Total Samples	Positive Cases
Male	1296	238
Female	2112	425
Total	3408	663

Table.2 Isolation Rate of Uropathogens

Organisms	Isolation Rate (%)
Escherichia coli	397 (59.8%)
Klebsiella spp	118 (17.7%)
Enterococcus spp	101 (15%)
Acinetobacter boumannii	32 (4%)
P.aeruginosa	20 (3%)
Proteus	5 (0.75%)

Table.3 Antimicrobial Susceptibility Pattern of Organisms Causing UTI

Antibiotic	*E.coli* (%)	*Klebsiella pneumonia* (%)	*Enterococcus spp* (%)	*Acinetobacter baumannii* (%)	*P.aeruginosa* (%)	*Proteus spp* (%)
Ampicillin	10	1	71			25
Amoxycillinclavulanate	36	45				50
Cefazolin	15	26				25
Cefuroxime	0					75
Ceftriaxone	19	49				75
Ceftazidime	50			31	61	
Cefepime	22	50		40	72	75
Cefotaxime	18	48				75
Ertapenem	79	81				100
Meropenem	81	85		46	83	100
Imipenem	82	85		46	83	100
Amikacin	34	38		53	83	50
Gentamicin	34	39	46	56		75
Ciprofloxacin	15	35	12.5	50	72	25
Cotrimoxazole	39	85				50
Nitrofurantoin	86	37	82			0
Minocycline	100			100		
Piperacillin tazobactam	45	43		46		100
Vancomycin			100			
Tetracycline			14			
Linezolid			100			
Teicoplanin			100			
Penicillin G						
Cefoxitin						
Erythromycin						
Clindamycin						

The prevalence of UTI in females (20%) is relatively high when compared to that of males (18%). The most effective antibiotics against Gram negative bacilli according to this study were Nitrofurantoin and Cotrimoxazole against Gram positive cocci were Ampicillin and Nitrofurantoin.

This study suggests that Nitrofurantoin, Ampicillin and Cotrimoxazole can be given empirically for UTI before availability of culture and sensitivity report. According to ICMR guidelines Nitrofurantoin, Fosfomycin, Cotrimoxazole, Amikacin, Ertapenem can be given for empirical treatment. Local antibiotic resistance patterns should be the basis for empiric treatment. UTIs are some of the most common bacterial infections, resulting in increased annual health care costs. Most of the uropathogens encode a wide range of virulence factors and the spread of antimicrobial resistance among them threaten the only effective antibiotic treatment options available. Uncomplicated UTIs are usually self-limiting and resolve quickly. Treatment of UTI is generally done empirically.

The study of bacterial pathogens causing UTI and their antimicrobial susceptibility pattern can guide the clinicians in the rational choice of antibiotic treatment so that misuse of antibiotics can be prevented.

Author Contribution

N. Sujeetha: Investigation, formal analysis, writing—original draft. P. Gnanaguru: Validation, methodology, writing—reviewing. K. Lakshmi:—Formal analysis, writing—review and editing.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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