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Medicine

The Frequency Causative Organisms and Their Sensitivity to the Commonly used Antibacterial Agents in Cases of Urinary Tract Infections

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ABSTRACT

Objective: Frequency causative organisms and their sensitivity to the commonly used antibacterial agents in cases of urinary tract infections.

Study Design: Observational study

Place and Duration of Study: This study was conducted at Medical Wards of Civil Hospital Karachi from 1st November 2010 to 30th April 2011.

Materials and Methods: This study consisted of 415 patients were selected for urine culture and sensitivity from medical O.P.D. and hospitalized patients in medical wards. Detailed history was taken from all the patients with special regard to symptoms and duration of UTI. Inclusion criteria were that all patients who had symptoms of urinary tract infection like frequency of micturition by day and night, painful voiding (dysuria), suprapubic pain and tenderness, hematuria, smelly urine, urgency , loin pain or swelling and patients who had more than 6 pus cells in urine D/R examination. Urine samples from OPD patients were randomly assigned to different reputable clinical pathological laboratories including pathological laboratory of Civil Hospital, Karachi, for urine culture and sensitivity.

Results: 415 patients 265(63.8%) were females and 150(36.2%) were males. 415 urine samples who were subjected to urine culture and sensitivity examination. Only 200 (48.2%) samples were found to had infection i.e. significant growth of 105 of microorganism/ml or more, while 142 (34.2%) samples did not show growth of any organism, and 73 (17.6%) samples showed growth between 104 and 105 of microorganism/ml . E. Coli 49.5% is the commonest organism causing UTIs in outpatients as well as in hospitalized patients. The second commonest organism in OPD is Klebsiella 16%, while in hospitalized patients it is Pseudomonas. The antibiotics susceptibility of the isolated organisms during the study and shows the percentage of sensitivity of the isolated organisms. E. coli the most common organism isolated showed high resistance pattern to ampicillin, amoxicillin, and co-trimoxazole 62%, 60%, 70%, respectively. E. coli the most common organism isolated showed a high sensitivity pattern to amoxicillin/clavulanic acid 85%, pipemidic acid 80%, norfloxacin 85%, ofloxacin 92%, ciprofloxacin 90%, tobramicin 98%. Generally a higher percentage of the organisms isolated were sensitive to all these antibiotics except amoxicillin/clavulanic acid which had a high resistance pattern to Pseudomonas 77%.

Conclusion: Escherichia coli is still the commonest organism causing urinary tract infection, in outpatients as well as in hospitalized patients.

Key Words: Urinary Tract Infections, antibacterial agents, sensitivity

INTRODUCTION

Urinary tract infections are the commonest bacterial infections managed in general practice[1] and nearly 10% of people will experience a UTI during their lifetime [2]. Urinary tract infection is responsible for much illness and contributes significantly to the cost of providing health care in economically developed countries [3]. Urinary tract infection is predisposed by factors which impairs urine flow [4].

Microbiologically, urinary tract infection exists when pathogenic microorganisms are detected in the urine, urethra, bladder, kidney or prostate. (W.E. Stamm, 1994)[5]. It was reported by Pryles and Lustik (1972) [6] that in a properly collected urine specimen, bacterial colony counts of 100,000/ml of microorganisms or greater represents "Urinary Infection", that bacterial colony counts between 10,000/ml & 100,000/ml of microorganisms represent "Probable Infection", and that bacterial colony less than 10,000/ml represent "Contamination".

Women are affected more frequently from urinary tract infections than men. A number of factors such as the patients state of hydration, the PH and specific gravity of the urine, the presence of bacteriostatic agent in the urine, and the presence of uretheral obstruction or

pyelonephritis in the patient, may influence the colony count[6].

The most common organisms isolated from patients with the urinary tract infection is Escherichia coli, which accounts for approximately 90% of cases in outpatient but only about half of the cases in hospitalized patients[7,8]. It has been further reported by Tierney et al (1994)[9] that out of 15 strains of Escherichia coli, most infections are caused by only five Zero group O_1,O_4,O_6,O_{18}, and O_{75}). The other organisms which may be involved include Proteus mirabilis, Klebsiella species, Staphylococcus saprophyticus, Staphylococcus epidermidis, Enterococci, other coliforms and Pseudomonas aeruginosa[10].

Since bacteria differ markedly in their resistance and susceptibility to the various antimicrobial agents, differing between species and strains of the same species, it is necessary that the clinician be informed not only about the identity of the bacteria but also the antibiotic sensitivity of that particular organism. Also the wide distribution of antibiotic resistant bacteria has made it necessary to determine the drug susceptibility patterns of almost all clinical isolates. In recent years, with the advent of new potent antimicrobial agents, it is becoming easy to control common bacterial infection. Yet their widespread and indiscriminate use are resulting in serious problems of bacterial resistance.

Keeping in consideration the newly developed concepts of treatment modes of urinary tract infections (UTIs), increasing resistance of the urinary tract pathogens to the commonly used antibiotics, and the fatal complications resulting from the undiagnosed or maltreated infections of urinary tract, the object of the present work (Purpose of study) is. To study the sensitivity of the common urinary tract pathogens to the commonly used antibiotics in the patients symptomatic of U.T.I.

MATERIALS AND METHODS

This study was conducted at Medical wards of Civil Hospital Karachi from 1st November 2010 to 30th April 2011. This study consisted of 415 patients were selected for urine culture and sensitivity from medical O.P.D. and hospitalized patients in medical wards. Detailed history was taken from all the patients with special regard to symptoms and duration of UTI . Inclusion criteria were that all patients who had symptoms of urinary tract infection like frequency of micturition by day and night, painful voiding (dysuria), suprapubic pain and tenderness, hematuria, smelly urine, urgency , loin pain or swelling and patients who had more than 6 pus cells in urine D/R examination.

Urine samples from OPD patients were randomly assigned to different reputable clinical pathological laboratories including pathological laboratory of Civil Hospital, Karachi, for urine culture and sensitivity. From hospitalized patients urine samples were collected in sterile screw capped containers as a mid stream urine or from urinary Foly's catheter with an asceptic technique. They were sent to the clinical pathological laboratory within an hour of collection. Data was analyzed through SPSS software.

RESULTS

UTIs is more common in females as compared to males. Of 415 patients 265(63.8%) were females and 150(36.2%) were males (Chart No.1).

415 urine samples who were subjected to urine culture and sensitivity examination. Only 200 (48.2%) samples were found to had infection i.e. significant growth of 10^5 of microorganism/ml or more, while 142 (34.2%) samples did not show growth of any organism, and 73 (17.6%) samples showed growth between 10^4 and 10^5 of microorganism/ml (Chart 2).

The distribution of patients with UTI who had a colony count of 10^5/ml or more. Of 200 positive urine cultures, 132 (66%) were isolated from females and 68(34%) were obtained from males .

E. Coli 49.5% is the commonest organism causing UTIs in outpatients as well as in hospitalized patients. The second commonest organism in OPD is Klebsiella 16%, while in hospitalized patients it is Pseudomonas (Table 1). The antibiotics susceptibility of the isolated organisms during the study and Table 2, and chart No.3 shows the percentage of sensitivity of the isolated organisms. E. coli the most common organism isolated showed high resistance pattern to ampicillin, amoxicillin, and co-trimoxazole 62%, 60%, 70%, respectively. Generally a higher percentage of the organisms isolated were resistant to these antibiotics as compared with other antibiotics as shown in Table 2 and chart No.3. E. coli the most common organism isolated showed a high sensitivity pattern to amoxicillin/clavulanic acid 85%, pipemidic acid 80%, norfloxacin 85%, ofloxacin 92%, ciprofloxacin 90%, tobramicin 98%. Generally a higher percentage of the organisms isolated were sensitive to all these antibiotics except amoxicillin/clavulanic acid which had a high resistance pattern to Pseudomonas 77% .

Table No.1: Break up of 200 Isolates

S. No.	Organism	O.P.D. Total No. (100)	Hospital (Total No. 100)
1.	E.Coli	53	46
2.	Klebseilla	19	13
3.	Pseudomonas	09	15
4.	Coagulase Negative Staphlococci	09	07
5.	Streptococcus Fecalis	02	10
6.	Staphlococcus Aureus	04	06
7.	Proteus	04	03

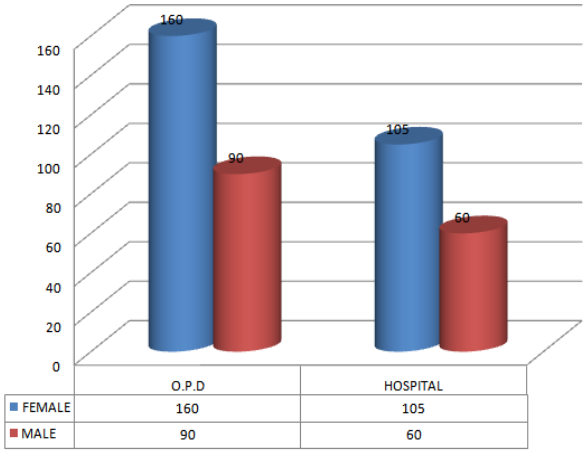


Chart No.1: Gender

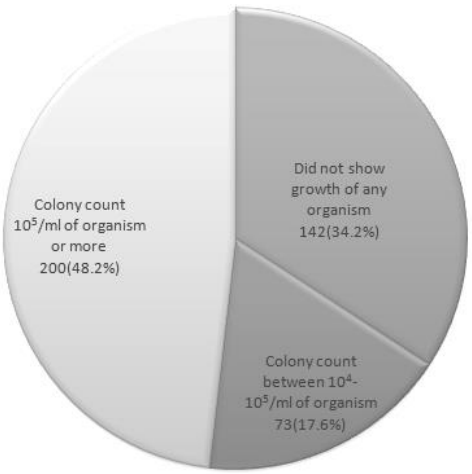


Chart No.2: Urine culture and sensitivity

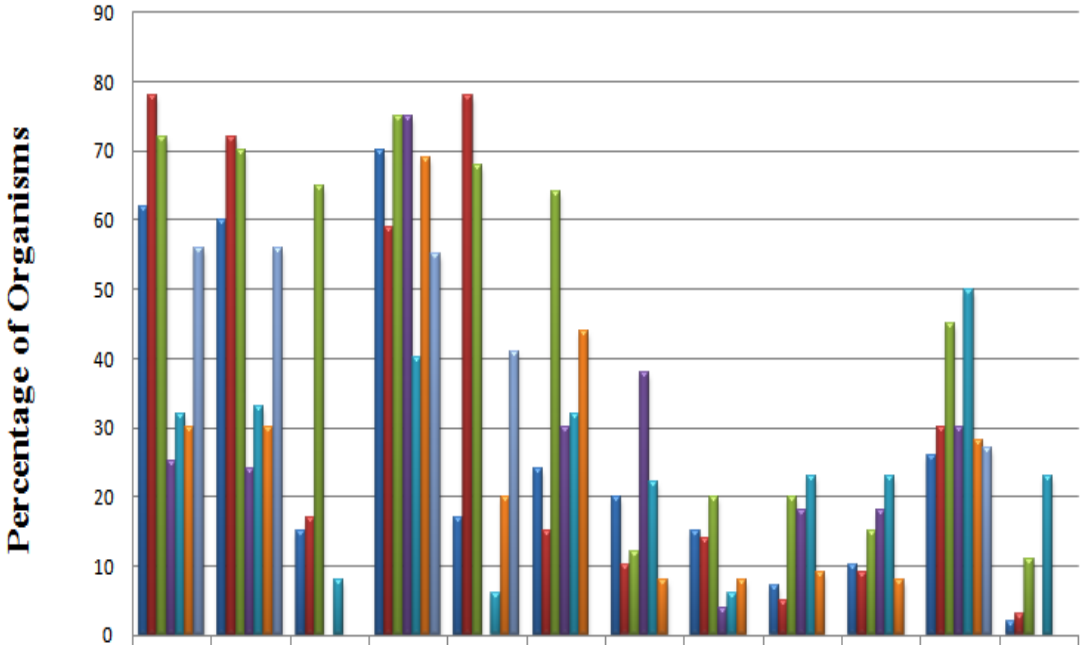
Table No.2: Percentage of sensitivity pattern of organisms isolated from urinary tract infections

S#	Name of Antibiotics	E.Coli	Klebseilla	Pseudo-monas	Coagulase Negative Staphlococci	Streptococcus Fecalis	Staphlo-coccus Aureus	Proteus
1.	Ampicillin	38	22	29	75	67	70	43
2.	Amoxicillin	40	25	29	75	67	70	43
3.	Amoxicillin/ Clavulanic Acid	85	81	33	100	92	100	100
4.	Co-trimoxazole	30	41	25	25	59	30	43
5.	Cephradine	83	22	33	100	92	80	58
6.	Nalidixic Acid	76	84	33	69	67	50	100
7.	Pipemidic Acid	80	87	84	63	75	90	100
8.	Norfloxacin	85	87	80	94	92	90	100
9.	Ofloxacin	92	94	80	82	75	90	100
10.	Ciprofloxa-cin	90	91	84	82	75	90	100
11.	Gentamicin	74	69	54	69	50	70	72
12.	Tobramicin	98	97	88	100	75	100	100

DISCUSSION

The antibiotic sensitivity pattern of organisms changes quickly over a short period. In developing countries where antibiotics are advised irrationally not only by the medical practitioners, family physicians, but the patients are also purchased directly from the pharmacy without prescription[11].

UTIs are much more common in women than men, due to short urethra in women approximately 1 to 1 1/2 inches long makes it easy for bacteria introduced to the urethra. Women are also more prone to developing UTIs following sexual intercourse, during which bacteria may inadvertently be introduced to the urethra. UTIs often occur due to unaccustomed frequency of sexual intercourse[12]. In ourstudy 265(63.8%) were females and 150(36.2%) were males.



	Ampicillin	Amoxicillin	Amoxicillin/clavulanic acid	Co-trimoxazole	Cephradine	Nalidixic Acid	Pipemidic Acid	Norfloxacin	Ofloxacin	Ciprofloxacin	Gentamicin	Tobramicin
E.Coli	62	60	15	70	17	24	20	15	7	10	26	2
Klebseilla	78	72	17	59	78	15	10	14	5	9	30	3
Pseudomonas	72	70	65	75	68	64	12	20	20	15	45	11
Coagulase negative Staphlococci	25	24	0	75	0	30	38	4	18	18	30	0
Streptococcus Fecalis	32	33	8	40	6	32	22	6	23	23	50	23
Staphlococcus Aureus	30	30	0	69	20	44	8	8	9	8	28	0
Proteus	56	56	0	55	41	0	0	0	0	0	27	0

Chart No.3: Resistant of organisms isolated from urinary tract infection.

In our study 415 patients who had more than 6 pus cells/HPF in urine D/R examination, 142 (34.2%) did not show growth of any organism on urine culture, 73 (17.6%) were found to had a colony count between 10,000 (10^4) and 100,000 (10^5)/ml of MSU (Mid Stream Urine) and 200 (48.2%) had a colony count of > 10^5/ml of microorganisms i.e. significant growth. This is in keeping with the studies carried out by Shaikh D et al. in (2002)[13] from Karachi Region.

Similarly symptoms are not a reliable indication of infection. Of 415 patients who had symtoms of UTI, only 200 (48.2%) patients had a significant growth of (10^5)/ml. Treatment with an appropriate antimicrobial agent is recommeded based on culture report. This is in keeping with the study carried out by Hafiz and Lyall in (1989)[(14)] from Karachi Region.

Frequency of E.coli was 49.5% significantly the most common isolated organism in our study. Studies from western & other countries also indicated E. coli ranged between 40-69% as the common urinary pathogen[15,16].

After E. coli the most frequent uropathogen was Pseudomonas 12% followed by Klebsiella 11%. However the study of Mahmood MA[1] reported prevalence of Pseudomonas aeruginosa (9%), Klebsiella spp. (9%), Enterococcus faecalis (9%), Staphylococcus aureus (4%), Proteus spp.(4%), Staphylococcus epidermidis (2%) and Acintobacter spp (1%).

Among Semi-synthetic Penicillins, ampicillin, amoxicillin, and amoxicillin/clavulanic acid were used in the study. Chart No 3 and Table 2 exhibits the Sensitive / Resistance pattern of these Semi-synthetic Penicillin on different isolates of UTIs. The result of present study indicates E. coli the most common isolate of UTI exhibiting high resistance to ampicillin (62%) and to amoxicillin (60%). Similarly Klebsiella which is the second major isolate exhibited even higher resistance than E. coli (ampicillin 78%, amoxicillin 72%). However the study of Nickel JC [17] reported patterns of E. coli prevalence and resistance, ampicillin, cotrimoxazole, and cefuroxime should not be

recommended for empiric therapy of UTI in all countries monitored.

From the results it is apparent that cephradine was most effective for E.coli only 17% were found resistant. For Pseudomonas and Klebsiella it is least effective, showed a sensitivity of 33% and 22% respectively. For Proteus it is moderately effective, showed sensitivity of 58%. The study indicates that cephradine was most effective for Gram positive organisims involved in UTI showed high sensitivity of 100% to Coagulase negative Staphlocoocus, 92% to Streptocoocus Fecalis, 80% to Staphlocoocus Aures.

The studies carried out by Ahmed et al in [18] indicated co-trimoxazole as the drug of choice for the treatment of UTI due to E. Coli (resistance of only 13% to E.Coli was indicated). However in a later study at Aga Khan University Hospital, Karachi carried out by Farooqui et al in [19] , the increase in resistance from 13% to 60% was indicated. The present study revealed a further increase in resistance to co-trimoxazole from 60% to 70% against E.Coli which is the most frequent causative agent of UTI.

In our study, the resistance observed by pipemidic was 20% due to Escherichia coli, 10% due to Klebsiella, and 12% due to Pseudomonas aeruginosa. While the resistance of nalidixic acid was 24% due to Escherichia coli, 15% due to Klebsiella, and 64% due to Pseudomonas aeruginosa. Table 14 Fig. 1. It is apparent from these studies that pipemidic acid is a more effective agent as compared to nalidixic acid. Whereas our study shows an increase resistance pattern to those reported earlier. However the study of Mahmood MA were reported highest resistance was recorded against cotrimoxazole (83%), ampicillin (81%)and trimethoprim (80%), followed by cefoxitin (71%), nalidixic acid (69%), gentamicin (68%), cefotaxime (67%), ciprofloxacin (57%) and norfloxacin (54%) in decreasing order[1].

Tobramicin was found highly effective against all the species isolated from UTIs and suggested that tobramicin is the drug of choice for treating UTIs.

The fluroquinolones used in the study included norfloxacin, ofloxacin and ciprofloxacin. The fluoroquinolones are considered more potent and have a much broad spectrum of antimicrobial activity than quinolones. They have much greater antibacterial activity, achieve bactericidal levels in blood and tissue, and have low toxicity. In the present study norfloxacin, ofloxacin, ciprofloxacin were found highly effective against all the species isolated from UTIs. Stamm and Norrby reported that ciprofloxacin (80%) had maximum sensitivity for Gram negatives and erythromycin (72%) for Gram positive organism[20]. Bano K reported resistance of the organism was 100% towards ceftazidine and imipenem while 50% for ciprofloxacin and pipercillin[21].

CONCLUSION

Escherichia coli is still the commonest organism causing urinary tract infection, in outpatients as well as in hospitalized patients. Infection due to Klebsiella species is on the rise. Resistance of UTI pathogens is rapidly increasing to co-trimoxazole, and gentamicin. For more serious hospitalized infections Tobramicin emerged as a drug of choice for treatment of UTIs. It is also stressed that urinary tract infections should be carefully investigated with respect to etiological agent and its antibiotic sensitivity pattern so as to achieve the prime goal of successful management.

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