A study on bacteriology of community acquired urinary tract and wound infections from Kanpur, North India

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Abstract
Introduction: The most common bacterial infections encountered by both general practitioners and hospital doctors in developing countries are Urinary Tract Infection and wound infections and are a major causes of morbidity. Appropriate timely empirical antimicrobial therapy may reduce the potential complications. In this study we have studied etiology and antibiogram of uropathogens and wound pathogens in Kanpur region. **Material and Methods:** In this study urine and pus samples were collected from 3 different centres in Kanpur region. The specimens were inoculated on the C.P.S media, MacConkey agar and sheep blood agar and bacteria were identified using standard methods. Antibiotic susceptibility testing was done by disc diffusion method following CLSI recommendations. **Results:** A total of 371 urine samples and 78 pus specimens were analyzed. Commonest uropathogens isolated was *Escherichia coli* followed by *Staphylococcus aureus* where as in pus samples most common isolate was *Staphylococcus aureus* followed by *Pseudomonas aeruginosa.* Antimicrobial sensitivity pattern of the bacterial isolates showed that majority of isolates were resistant to commonly used oral antibiotics like Norfloxacin first and second generation Cephalosporins and Co-Trimoxazole. Fortunately most of the isolates were sensitive to injectable broad spectrum antibiotic like Amikacin, Cefoperazone/sulbactum, Piperacillin/tazobactum, Meropenem etc. **Conclusion:** The drug sensitivity pattern of community acquired bacteria in Kanpur region is very disturbing and it is strongly advocated that the clinicians should send a sample for bacterial culture and sensitivity before starting antibiotic therapy.
Key Word: Antibiotic resistance, Kanpur, Urinary Tract Infection, Wound Infection.

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INTRODUCTION

Bacterial infections in developing countries still remain to be a major cause of morbidity and mortality.[1] they could be community acquired or hospital acquired infections. Community acquired infection can be defined as onset of infection prior to hospital admission and not within 10 days of hospital discharge.[2] The problems associated with community acquired infection are broad and extends from asymptomatic infection to life threatening conditions like pneumonia and blood stream infections.[3]The prevalence of community acquired infections is higher in metropolitans than in rural and semi urban areas.[4-5] Urinary tract infections (UTIs) and wound infections are among the most common bacterial infections encountered by both general practitioners and hospital doctors and

constitutes one of the major causes of morbidity.[6] The infecting microorganism may be aerobic or well anaerobic bacteria includes *staphylococcus aureus, Enterococcus spp, Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumoniae, Enterobacter species, Proteus mirabilis*, *Candida albicans, Acinetobacter spp,* other gram-positive aerobes and anaerobes.[7] Development of such infection cause prolonged antibiotic treatment, causes anxiety and discomfort in patient, prolongs hospital stay and add to cost of healthcare services significantly. Appropriate empirical antimicrobial therapy may reduce the potential for complications. Choice of appropriate antibiotics depends on the knowledge of common organisms and their antimicrobial susceptibility pattern in local scenario.[6] No such data concerning the etiology and antibiogram of wound pathogens and uropathogens in Kanpur, UP have been published till date. We hope this study will help the clinicians to become familiar with the common pathogens responsible for these infections and their antimicrobial susceptibility patterns, which will definitely help the clinicians to choose the proper empirical antimicrobial therapy.

MATERIAL AND METHODS

In this study the clinical specimens are urine and pus samples collected from 3 different centers (1) The Doctor's X-ray and pathology Institute Pvt Ltd. Civil lines, Kanpur. (2) Akash ganga centre, Shuklaganj, this centre is located outside main Kanpur city and caters to semi-urban population. (3) Akash ganga centre, Unnao. This centre is located 25 Kms from Kanpur city and covers rural population. The sample were collected using aseptic precautions and transferred to microbiology department at New leelamani hospital, Kanpur and all the microbiological processing was done there. The duration of study is 6 months that is from October 2013- March 2014. The specimen were inoculated on the C.P.S media (biomeriux, france), MacConkey agar (Himedia, Bombay), Sheep blood agar (BioMeriux, france) using sterile loop. All the isolates were identified using colony morphology on blood agar, MacConkey agar, Gram stain characteristics, motility detection, sugar fermentation reactions, indole production, urea hydrolysis, citrate utilization etc. Antibiotic susceptibility testing was done on Mueller Hinton agar by Kirby-Bauer disc diffusion method following CLSI recommendations.[8] Final isolate identification and susceptibility testing was done using Vitek 2-Compact (BioMeriux, France)

RESULT

During the study period a total of 371 urine samples and 78 pus specimens were analyzed. In urine pathogens were isolated in 209 specimens (positivity 57%). Commonest bacteria isolated were *Escherichia coli* followed by S*taphylococcus aureus*. Antimicrobial sensitivity pattern of the isolate showed that 70 – 80% isolates were resistant to commonly used oral antibiotics like Norfloxacin, Ciproloxacin and cefuroxime, however sensitivity to Nitrofurantion was > 80%. Resistance to frequently used injectable cephalorosporins was alarmingly high at 60-70%, thus indicating a high prevalence of ESBL and Amp-c genes in community acquired bacteria. However most of the isolates were sensitive to broad spectrum injectable antibiotics like cefoperazone/sulbactum, piperacillin/ tazobactum, meropenem etc. (Table 1) Among the 79 pus sample processed, growth was observed in 70 samples. (Postivity 88.6 %) Single organism was isolated in most of the specimens, 2 bacteria were isolated from 10 samples and 2 specimen showed growth of 3 bacteria. Most common isolate was *Staphylococcus aureus 27* (34.17%) followed by *Pseudomonas aeruginosa 25(31.64%), Escherichia coli 7(8.86%), Klebsiella pneumonia 6(7.59%), Enterobacter spp., Enterococcus spp, and Serratia odorifera etc.* The antibiogram of these isolates is tabulated in table :(2)

DISCUSSION

In this study we have evaluated the etiology and antimicrobial susceptibility patterns of uropathogens and bacteria causing wound infections in Kanpur region. The study was conducted at 3 centres (1) The Doctor's X-Ray and pathology institute pvt. Ltd, Kanpur city. (2)Akash Ganga Diagnostic centre, Shuklaganj . (3) Akash Ganga Diagnostic centre, Unnao . In this study it was noticed that urinary tract infection was more prevalent in females. This is an agreement with other reports which stress that urinary tract infection is frequent in females than in males, sduring youth and adulthood. This is as a result of shorter and wider urethra and the anatomical relationship of the female's urethra and the vagina makes it liable to trauma during sexual intercourse as well as bacteria been massaged up to urethra in to the bladder during pregnancy and child birth.[9-10] Similar finding have been reported by Acharya *et al* from Nepal,[6] they showed that UTI is more common in females than in males. It has been proven in several studies that women who are sexually active and especially if the use a diaphragm and spermicide for contraception are at increased risk.[11]Commonest uropathogen isolated was *Escherichia coli* followed by *Staphylococcus aureus.* These finding are similar to those reported by Acharya *et al* from Nepal,[6] *E-coli* was

predominant bacterial isolates and accounted for (68%) of the total isolates followed by *Enterobacter spp (13%).and Klebsiella spp(5%)*. Maya *et al* from Tamilnadu also showed as commonest uropathogen. *E-coli* (55%) followed by *Klebsiella pneumoniae* (20%).[3] The problem of bacterial antibiotic resistance emerged as soon as the first antibiotic become available for clinical use. One of the aims of this study was to determine the sensitivity pattern of Antimicrobials agents commonly used .The antimicrobial sensitivity pattern of *E-coli* isolated from patients with complicated and uncomplicated urinary tract infection revealed an increased resistance to the usual drugs of choice for urinary tract infection such as Norfloxacin, Cephalosporins and Co-Trimaxazole. This was also seen in the study of Hootan *et al* which recommended that Amoxycillin, ampicillin, ampicillin/sulbactum and Co-Trimaxazole should not be used in the treatment of complicated urinary tract infection.[12] The drug sensitivity pattern is very disturbing as it shows that oral antibiotics agents are resistant in more than 50% isolates, thus it is no longer safe to prescribe antimicrobial agents without urine culture testing. Secondly the most alarming finding noticed in the study is high drug resistance pattern in rural centre (Unnao) as compared to urban centres(civil line).This is probably due to indiscriminate use of antibiotics and lack of availability of specialist doctors in rural areas leading to self medication. A total of 79 patients with infected wounds were enrolled for this study. The age of the study groups ranged from 1 year to 74 years of the 79 pus specimens cultured growth was seen in 70 samples. *Staphylococcus aureus* was most common isolate and followed by *Pseudomonas aeruginosa* .Similar finding have been reported by Nwachukwu *et al* from Nigeria and they also reported at *Staphylococcus aureus* and *Pseudomonas aeruginosa* as the major microbial pathogen associated with wound infection .These result is consistent with the CDC-USA data and also reflects data from other studies. On studying the antibiotic sensitivity pattern of the isolated bacteria, it was seen that commonly used Oral antibiotics on patient with for pus like Amoxycillin/Clavulanic Acid, Cefuroxime, Cefexime were not effective on bacteria in >50% cases, however fortunately the resistance to Quinolones (Ciprofloxacin, Ofloxacin, Prulifloxacin, Levofloxacin) is relatively less. Data on injectable antibiotics demonstrate that Gentamycin has less efficiency in Kanpur region but other injectables like Amikacin, Piperacillin/Tazobactum, Cefoperazone/sulbactum, carbapenem etc can be safely used. Low resistance to 3rd generation Cephalosporins also demonstrate absence of E.S.B.L producing strains in pus sample in Kanpur region. In a similar study by Raja *et al* from Malaysia. Amikacin are the most effective

agents against whole gram negative organism. [13] According to Seppala *et al*, 1992 majority of gram negative bacteria isolated were sensitive to gentamicin, ceftazidime and ciprofloxacine .[14]However, most of the gram negative bacteria isolated were resistance to ampicilline, chloramphenicol and ciprofloxacin are third generation cephalosporins that are relatively rare in the hospitals and are the expensive. [15] Thier high cost and being less readily available to patients means these drugs have not been misused and hence are more effective compared to those that have been in use for quite a long time.[16]

CONCLUSION
The drug sensitivity pattern of community acquired bacteria in Kanpur region is very disturbing and it is strongly advocated that the clinicians should send a sample for culture sensitivity before initially antimicrobial treatment. Further the need of the hour is that health agencies should formulate guidelines for prescribing antibiotics and doctors should adhere to it, otherwise a day will come where we will find ourselves in pre antibiotic era.

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Table 1: Antibiotic resistance pattern of uropathogens

Antibiotics	Civil lines		Unnao		Shuklaganj	
	Gram (+)	Gram (-)	Gram (+)	Gram (-)	Gram (+)	Gram (-)
Penicillin						
1. Amoxycillin / Clavulanic Acid (oral/i.v)	17%	73%	34%	76%	55.60%	81%
2. Piperacillin / Tazobactum (i.v)	0%	0%	16%	7%	11%	19.80%
3. Amoxycillin / Sulbactum (i.v)	0%	79%	34%	79%	45%	90.50%
Carbapenem						
4. Imipenem (i.v)	0%	0%	0%	9.40%	0%	5%
5. Meropenem (i.v)	0%	13%	4%	11.30%	11.90%	28.80%
Cephalosporins						
6. Cefuroxime (oral)	67%	76%	55%	75.80%	56%	86%
7. Cefexime (oral)	67%	73%	82%	79%	78%	86%
8. Cefotaxime (i.v)	67%	64%	52%	65.50%	67%	67%
9. Ceftriaxone (i.v)	67%	60.90%	55%	65.50%	78%	67%
10. Ceftazidime (i.v)	67%	44%	**70%**	**49%**	89%	58%
11. Cefoperazone/Sulbactum (i.v)	0%	7%	16.00%	14.10%	23%	29%
12. Cefepime (i.v)	50%	43%	52%	44.80%	78%	57.20%
Quinolones						
13. Norfloxacin (oral)	67.00%	79%	94.%	55.2%	89%	86%
14. Ciprofloxacin (oral)	67%	79%	73%	75.8%	89%	86%
15. Ofloxacin (oral)	34%	72.90%	31%	72%	67%	98.20%
16. Prulifloxacin(oral)	67%	70%	64%	65.5%	78%	76.20%
17. Levofloxacin (oral)	17%	55%	49%	68.290%	56%	71.50%
Sulphonamides						
18. Co-Trimoxazole (oral)	50%	82%	79%	56.1%	100%	76.20%
Aminoglycosides						
19. Gentamycin (i.v/i.m)	34%	19%	40%	78%	45%	48%
20. Amikacin (i.v/i.m)	17%	10%	0%	40.2%	23%	20%
21. Tobramycin (i.v/i.m)	34%	22%	16%	15%	23%	29.0%
22. Netilmycin (i.v/i.m)	34%	19%	16%	24.3%	34%	14%
NITROFURANS						
23. Nitrofurantion (oral)	17%	28%	16%	10%	12%	29%
Tetracycline Analogue						
24. Tigecycline (i.v)	0%	13%	0%	9.4%	0%	10%
Special Antibiotics in Gram Negative Bacteria			-			
25. Colistin (i.v)	-	25%	-	20%	-	10%
Special Antibiotics in Gram Positive Bacteria						
26. Vancomycin (i.v)	17%	-	4%	-	0%	-

27. Linezolid (oral/i.v)	17%	-	4%	-	12%	-
28. Clindamycin (oral/i.v)	50%	-	46%	-	56%	-
29. Azithromycin (oral/i.v)	67%	-	55%	-	67%	-
30. Pristinomycin (Quinopristin/dalfopristine)combination	67%	-	58%	-	67%	-
31. Methicllin	67%	-	49%	-	78%	-
32. Cefoxitin	83.30%	-	49%	-	78%	-

Table 2: Antibiotic resistance pattern of the isolated bacteria in pus

	Anitibiotics	Civil lines	Unnao	Shukla ganj
	Penicillin			
1	Amoxycillin/Clavulanic Acid (oral/i.v)	50%	60%	80%
2	Piperacillin/Tazobactum(i.v)	0%	5%	0%
3	Amoxycillin/Sulbactum(i.v)	50%	35%	80%
	Carbapenem			
4	Imipenem(i.v)	0%	8%	0%
5	Meropenem(i.v)	0%	3%	0%
	Cephalosporins			
6	Cefuroxime(oral)	50%	60%	80%
7	Cefexime(oral)	50%	70%	80%
8	Cefotaxime(i.v)	10%	40%	10%
9	Ceftriaxone(i.v)	10%	15%	10%
10	Ceftazidime(i.v)	10%	20%	10%
11	Cefoperazone/Sulbactum(i.v)	0%	12%	0%
12	Cefepime(i.v)	0%	20%	0%
	Quinolones			
13	Norfloxacin(oral)	50%	60%	70%
14	Ciprofloxacin(oral)	10%	44%	20%
15	Ofloxacin(oral)	10%	33%	30%
16	Prulifloxacin(oral)	10%	44%	30%
17	Levofloxacin(oral)	10%	16%	10%
	Sulphonamides			
18	Co-Trimoxazole(oral)	40%	75%	100%
	Aminoglycosides			
19	Gentamycin (i.v/i.m)	50%	24%	50%
20	Amikacin (i.v/I.m)	10%	15%	20%
21	Tobramycin (i.v/i.m)	10%	12%	18%
22	Netilmycin (i.v./i.m)	10%	10%	10%
	Nitrofurans			
23	Nitrofurantion (oral)	50%	50%	100%
	Tetracycline Anaogue			
24	Tigecycline(i.v)	20%	28%	30%
	Special Antibiotic in Gram Negative Bacteria			
25	Colistin(i.v)	20%	20%	20%