Vol. 1, No. 1
Fall 1989

SCREENING FOR ANTIBIOTIC RESISTANT BACTERIA IN URINE SAMPLES

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Abstract

Chronic urinary tract infections are often caused by antibiotic resistant bacteria. In some of these cases, prediction of the most effective antibiotic (s) may urgently be needed. This can not be achieved unless the nature and patterns of the resistance to antibiotics among the pathogenic bacteria has been described earlier. The urine samples that reached the laboratory of Shaheed Mustafa Khomeini Hospital (SMKH) during a two-year period were screened for the incidence, nature, percentage and patterns of antibiotic resistant bacteria. The results showed that about 92% of the total isolates were related to the Enterobacteriacae group and more than 94% of these strains were resistant to two or more antibiotics simultaneously. Nalidixic Acid, Amikacin, and Nitrofurantoin were classified as the most effective antibiotics. While Ampicillin, Cephalothin and Carbencillin were found to resist more than 75% of the total isolated pathogens. The percentages of resistance to other antibiotics ranged between 41% and72%.These results suggest that more restrictions should be imposed on the sale and/or use of antibiotics in Iran.

Introduction

The infectious agents that are resistant to antibiotics are usually eradicated after the determination of the most effective antibiotic(s) by an ***in vitro*** assay. Their distribution in the hospital environment often creates serious health problems for the patients as well as for the hospital staff. Therefore, the assessment and continuous monitoring of the resistant pathogens inside and outside the hospital environment are needed for describing their nature and pattern of resistance.

This approach will help in evaluating and knowing the most effective antibiotic(s) among the large number of these drugs which are routinely used and avaliable. It is also neccessary for the prediction and choice of a drug in the treatment of emergency cases where there are no laboratory facilities avaliable. Moreover, these investigations will provide a data base for the implementation of an effective and long-term purchase plan for keeping the needed amount of antibiotics in stock at the hospital.

Obviously, these measures will help to bring down the cost of treatment per patient. Therefore, a comprehensive research study was planned to screen all samples upon arrival to the laboratory for the presence of antibiotic resistant pathogens. These data and those of septic wounds (Jabbar et al., 1986) are reported and a series of investigations that include stool, sputum, ear and throat swab samples are in progress.

Materials and Methods

Urine samples that reached the laboratory of SMKH during a two-year period were screened for the presence of antibiotic resistant bacteria. The methods of Finegold and Martin (1982) were adopted in the screening procedures. The data presented in this report represent 16% of the total urine samples which were sent to the laboratory during that period. This means that 84% of the urine samples showed no growth on the routinely used media (data not presented). Sensitivity discs used in this study were purchased from Biomerieux Co., Char Bonnieresles Bain; France; and BBL Microbiology Systems, Becton, Dickinson and Co., Cockeysville, MD 21030.

Results and Discussion

The pathogenic bacteria which were isolated from urine samples were identified according to procedures described by Finegold and Martin (1982). The identified species are presented in Table 1. In this table, **E. coli** was shown to be the most frequent pathogenic bacteria in urinary tract infections. They form about 72% of the total number of isolated bacteria. Gram (+) cocci which was isolated from urine samples form only about 8%. One Gram (−) diplococcus was reported within these strains but was counted as an experimental error. The other isolated pathogens form about 20% of the total isolated bacteria.

As these bacterial isolates were reported from about 455 urine samples, only the genus names were mentioned.

The frequent incidence of **E. coli** in urinary tract infections has been reported elsewhere (Palac, 1986; Kraft and Stamey, 1977). The actual reason for this event is not clear. However, Kraft and Stamey, 1977, believe that the presence of type I Common Pili on the external membrane of **E. coli** is crucial to the organism's pathogenicity in urinary tract infections of old women.

The sensitivity of the isolated pathogens to 12 routinely used antibiotics is described in Table 2. A few of these antibiotics were found effective in ***in vitro*** assays by killing the majority of the causative agents of urinary tract infections that had been tested according to the procedure described in Finegold and Martin (1982). Amikacin, Nalidixic Acid and Nitrofurantoin were found to resist by 11%, 13% and 16% of the isolated bacteria respectively. Tobramycin as a new antibiotic in the Iranian market, was found to resist by 28% of the tested strains. The resistance to Tobramycin is less than that of Gentamycin among the causative agents of urinary tract infections. However, in septic wound samples, there were no significant differences between these two structurely related antibiotics (data are not presented).

On the other hand, Ampicillin, Cephalothin and Carbencillin were found to resist by 86%, 82% and 75% of the tested strains respectively. Such results are similar to what has been reported in septic wounds (Jabbar et al., 1986). The high level of resistance to these antibiotics among the isolated strains could be related to their unrestricted use in the Iranian society. Meanwhile, these three antibiotics are not classified as the drug preferred for the treatment of urinary tract infections.

The other antibiotics were found moderately active in the treatment of urinary tract infections and were resisted by 41% to 72% of the total isolated pathogens. The order of resistance of these twelve antibiotics are as follows:
Ampicillin > Cephalothin > Carbencillin > Tetracycline > Kanamycin > Bactrim > Chloramphenicol > Gentamycin > Tobramycin > Nitrofurantoin > Nalidixic Acid > Amikacin.

The patterns of resistance to antibiotics among some isolated pathogens are presented in Table 3. This table shows that about 94% of the isolated bacteria were resistant to two or more antibiotics simultaneously. However, some of these multiple-resistant bacteria showed a resistance to the antibiotics which have top priority in the treatment of urinary tract infections, such as Nitrofurantoin and Nalidixic Acid.

In conclusion, Ampicillin, Cephalothin and Carbencillin seem to be of very little value in the urgent treatment of

Isolated Bacteria	Number of Isolates	Percentage
E. coli	327	71.9
Klebsiella spp.	45	10.0
Enterobacter spp.	30	6.6%
Proteus spp and other Gram (-) bacilli	18	3.9%
Gram (+) cocci	35	7.6%
Total	455	100%

Table 1: The numbers and percentages of the bacterial pathogens that were isolated from urine samples

Antibiotic	R	S	T	%
Amikacin (AN 30ug)	311	40	351	11%
Nalidixic Acid (NA 40 ug)	349	52	401	13%
Nitrofurantoine (Fm 100 ug)	341	65	406	16%
Tobramycin (NN 10ug)	264	101	365	28%
Gentamycin (Ge 10ug)	192	131	323	41%
Chloramphenicol (C 30 ug)	157	153	310	49%
Bactrim (SXt: Trimetho Prime + Sulphamethoxazol)	128	184	312	59%
Kanamycin (K 30 ug)	44	108	152	71%
Tetracycline (Te 30ug)	120	314	434	72%
Carbencillin (CB 100ug)	101	302	403	75%
Cephalothin (Cf 30ug)	22	101	123	82%
Ampicillin (Am 25ug)	33	205	238	86%

S = Sensitive; R = Resistant; T = Total; % = Percentage of resistance

Table 2: The percentages of resistance to some routinely used antibiotics among the pathogenic bacteria isolated from urine samples

Pattern of resistance	Counted Number	Percentage
Am Te K C CB GE	14	5.7%
Am Te K C CB Sxt	18	7.4%
Am Te K C CB	25	10.2%
Am Te CB Sxt	29	12.0%
NN Ge NA Fm	11	4.5%
NN Ge C Te	9	3.7%
Am Te C CB	14	5.7%
Am Te CB	18	7.4%
Other multiple resistant patterns	92	37.8%
Patterns of resistance to one antibiotic	5	2.0%
No. of isolates sensitive to all antibiotics tested	9	3.6%
Total no. and percentages of multiple resistant bacteria	230	94.4%
No. of the counted bacteria	244	—

Table 3: Patterns of resistance to twelve antibiotics among 244 strains of bacteria isolated urine samples

urinary tract infections where there is no information on the sensitivity of the pathogenic bacteria to these antibiotics. In fact, these antibiotics are effective in killing less than 20% of the pathogenic bacteria in ***in vitro*** assays. It is clear that only a few antibiotics (among those included in this report) are useful for the treatment of the majority of infections of the urinary tract. These are, Amikacin, Nalidixic Acid, Nitrofurantoin and possibly Tobramycin. So that these antibiotics may be recommended over others for the treatment of emergency urinary tract infections where there is no information on the sensitivity of the causative agent(s) to the avaliable antibiotics. It may be neccessary to remind the medical staff that the prediction of an effective antibiotic(s) for the treatment of urinary tract infections will be a difficult task due to a prevailing resistance to avaliable antibiotics.

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