

Antibiotic resistance pattern of mdr pathogens

Priti Vyas

Dept. of Biotechnology, P.M.B. Gujarati Science College, Indore

Abstract—Multiple drug resistant enterobacterial pathogens were isolated from common sources of human consumption. The isolates were subjected for antibiotic susceptibility testing against 10 antibiotics and found to be resistant towards six antibiotics. All the isolated MDR pathogens were found to be sensitive towards amikacin. Sensitivity for cefuroxime, oxacillin, and metronidazol differed for different species. The pattern of MDR bacteria was perturbing as simultaneous resistance to chloramphenicol and gentamycin, formed the common MDR pattern. The pattern was almost the same for the diverse species (*Escherichia coli*, *Klebsiella pneumoniae*, *Citrobacter diversus*, *Shigella flexneri*, *Salmonella typhi*, *Proteus vulgaris*, *Citrobacter freundii*, *Proteus myxofaciens*, *Klebsiella oxytoca*, and *Pseudomonas aeruginosa*) isolated from different food samples and strongly suggests prevalence of similar R plasmids. This suggests that antibiotic resistance is encoded on a high molecular weight plasmid, and can easily spread in the community through food stuff generally consumed by the common man.

Keywords—MDR, antibiotics, enterobacterial pathogens.

I. INTRODUCTION

Very large number of publications appeared in the literature concerning the development of drug resistance in a variety of microbes present in food items, fruit juices, sweets, sprouts, milk and milk products, fresh and marine waters. The fear of transfer of multidrug resistance to pathogens like *Salmonella typhi* came true in 1972 resulting in an epidemic of chloramphenicol resistant *S. typhi* and in 1992 another epidemic with simultaneous resistance for chloramphenicol, co-trimoxazole and ampicillin (Chitnis *et al.*, 2000). *Salmonella sp.* is responsible for an estimated 0.8 to 4.0 million infections in the United States each year usually taking the form of gastroenteritis following the consumption of contaminated food. The incidence of resistant bacteria in foodstuff is a worldwide phenomenon. It is a major public health threat (Rahman and Malik, 2001).

The occurrence of transferable drug resistance mediated by plasmids, called R factor, has been extensively documented since it was first observed in Japan in 1959. Mandal *et al.* (2004) investigated the occurrence of R-plasmids among MDR isolates of *Escherichia coli*, *Proteus vulgaris* and *Klebsiella pneumoniae* from different clinical cases isolated from in and around Calcutta, India. The multidrug resistant *S. typhi* strains contained a transferable plasmid conferring resistance to ampicillin, chloramphenicol, cotrimoxazole and tetracycline. The spread of antibiotic resistance among pathogenic bacteria thus posed a serious problem of therapeutic failure during the treatment of infectious diseases. The adaptation to antibiotics present in the aqueous environment is due to acquisition and dissemination of simple antibiotic resistance genes by mobile genetic elements (Cruz and Davies, 2000). As described by Gaynes and Monnet (1997), some contributing factors include cross transmission, inter hospital resistance transfer, a community contribution to resistance and the use of a variety of antibiotics.

The present study aims at isolation and characterization of MDR enterobacterial pathogens from various food samples. These samples are consumed by the common man in India, thru which infection could occur which could be difficult to cure due to their multiple drug resistant nature.

II. MATERIALS AND METHODS

Ten MDR pathogens were isolated from various sources including food items consumed by the common man. All organisms were isolated on chloramphenicol and gentamycin supplemented MacConkey agar and identified as members of Enterobacteriaceae. Antibiotic susceptibility testing was conducted on Muller-Hinton agar using disc diffusion method described by Bauer *et al.* (1966) using commercial antibiotic discs purchased from Hi-media Laboratories. The discs were placed on Muller-Hinton agar previously seeded with 0.5 ml test culture grown for 24 h. The antibiotics used were Nalidixic acid, Gentamycin, Chloramphenicol, Metronidazole, Ciprofloxacin, Amikacin, Norfloxacin, Oxacillin, Cefuroxime and Ampicillin. The antibiotic resistance pattern was recorded after incubation of plates at 37 °C for 48 h.

III. RESULTS AND DISCUSSION

Table 1 demonstrates the antibiotic resistant phenotypes of MDR pathogens used in the study. The organisms were found to be resistant towards almost all the antibiotics. All the isolated MDR pathogens were found to be sensitive towards amikacin. Sensitivity for cefuroxime, oxacillin, and metronidazol differed for different species.

Genus and species	Sensitivity pattern	Resistance phenotypes
<i>Escherichia coli</i>	Ami	Cip, N A, Amp, Cef, Oxa, Met , <u>Gen, Chl</u> , Nor
<i>Klebsiella pneumoniae</i>	Ami, Cef, Oxa	Cip, N A, Amp, Met , <u>Gen, Chl</u> , Nor
<i>Pseudomonas aeruginosa</i>	Ami	Cip, N A, Amp, Cef, Oxa, Met , <u>Gen, Chl</u> , Nor
<i>Citrobacter diversus</i>	Ami	Cip, N A, Amp, Cef, Oxa, Met , <u>Gen, Chl</u> , Nor
<i>Shigella flexneri</i>	Ami	Cip, N A, Amp, Cef, Oxa, Met , <u>Gen, Chl</u> , Nor
<i>Klebsiella oxytoca</i>	Ami, Cef	Cip, N A, Amp, Oxa, Met , <u>Gen, Chl</u> , Nor
<i>Salmonella typhi</i>	Ami, Cef	Cip, N A, Amp, Oxa, Met , <u>Gen, Chl</u> , Nor
<i>Proteus vulgaris</i>	Ami	Cip, N A, Amp, Cef, Oxa, Met , <u>Gen, Chl</u> , Nor
<i>Citrobacter freundii</i>	Ami, Cef	Cip, N A, Amp, Oxa, Met , <u>Gen, Chl</u> , Nor
<i>Proteus myxofaciens</i>	Ami, Oxa, Met	Cip, Cef , N A, Amp, <u>Gen, Chl</u> , Nor
Ami – Amikacin, N A- Nalidixic acid, Cef – Cefuroxime, Amp- Ampicillin, Oxa – Oxacillin, Met – Metronidazol, Gen – Gentamycin, Chl – Chloramphenicol, Cip – Ciprofloxacin, Nor – Norfloxacin. Conc. of each antibiotic = 10 µg / disc.		

Maximum number of isolates was found to be associated with the swabbing of tea glasses and plates, and found to contain *Escherichia coli*, *Klebsiella pneumoniae*, *Citrobacter diversus* and *Proteus vulgaris*. The next major source of MDR pathogens was water sprinkled on vegetables by vegetable vendors and found to contain *Escherichia coli*, *Citrobacter diversus*, *Shigella flexneri*, *Citrobacter freundii*, *Klebsiella oxytoca* and *Pseudomonas aeruginosa*.

In the aqueous environment, the transfer of resistance factor within and between the bacterial genera has been shown by Grabow and Prozesky (1973) using *Escherichia coli* resistant to ampicillin, chloramphenicol, sulfonamide and tetracycline. The MDR isolates collected during the present study indicated the presence of plasmids of almost identical size of approximate 60 kb, however an opportunistic pathogen *Pseudomonas aeruginosa* contained a plasmid of slightly higher molecular weight.

The pattern of MDR bacteria was perturbing as simultaneous resistance to chloramphenicol and gentamycin, formed the common MDR pattern. The pattern was almost the same for the diverse species (*Escherichia coli*, *Klebsiella pneumoniae*, *Citrobacter diversus*, *Shigella flexneri*, *Salmonella typhi*, *Proteus vulgaris*, *Citrobacter freundii*, *Proteus myxofaciens*, *Klebsiella oxytoca*, and *Pseudomonas aeruginosa*) and strongly suggests prevalence of similar R plasmids. These results can be co-related with the antibiotic patterns of the isolates. Almost similar antibiotic resistance pattern was observed for all isolates. These results suggest that antibiotic resistance is encoded on a high molecular weight plasmid as also suggested by Chitnis *et al.*, (2000). They reported similar MDR pattern in diverse species and presence of similar plasmid DNA bands on gel electrophoresis and demonstrated the presence of high molecular weight R plasmids (>10 kb) in MDR isolates obtained from hospital effluents. The present study confirms that the antibiotic resistance is encoded on a high molecular weight plasmid, and can easily spread in the community thru food stuff generally consumed by the common man.

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