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Emerging antibiotic resistance of *Pseudomonas aeruginosa* isolated from various drinking water sources of Rewa city (M.P)

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ABSTRACT

In the present study, seven water samples from various drinking water sources situated in Rewa city were collected in the months of Sept. 2006 to June 2007. In which the three water samples showed the presence of pathogenic bacteria *Pseudomonas aeruginosa*, where as single strain of *Pseudomonas aeruginosa* was isolated and identified from each of the three water samples thus a total three *Pseudomonas aeruginosa*, strains were observed for their antimicrobial sensitivity using various antibiotics viz., Amikacin, Benzylpenicillin, Cefotaxime, Chloramphenicol, Gentamicin, Streptomycin and Tetracycline Antibigram of these three strains of *Pseudomonas aeruginosa*, showed that all the strains were found sensitive to chloramphenicol, and Streptomycin, were as equal percentage of strains were observed both sensitive and resistance to Benzylpenicillin and Cefotaxime, but 66.6% strains were found also resistance to Gentamicin. Thus high incidence of bacterial resistance to antibiotics was seen in drinking water.

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INTRODUCTION

With increasing environmental pollution it is absolutely necessary to ascertain the potability of water before used for human consumption. Water is one of the major carriers of several diseases of bacteriological origin and hence careful assessment of bacteriological origin and hence careful assessment of bacteriological quality of water is most essential.

Intestinal micro-organisms from warm blooded animals including man enter river streams and large bodies of water contributing to the pollution of the environment. Among these intestinal microbes are the coliforms. Pathogenic forms may be in evidence but the numbers and the types will vary with the geographic area, the state of community health, the nature and degree of sewage treatment and physiological state of the organ-

isms^[11].

The incidence of *Pseudomonas aeruginosa* in human faecal specimens was determined by Sutter et al.^[36]. About twelve percent of the healthy adults or employees in medical or dental school discharged the organisms in number upto 10 g-1 of faeces. It appeared persistently in some individual but only transiently in others. Bondey^[6] recovered *Pseudomonas aeruginosa* from sewage and polluted fresh water and sea water then sufficiently large numbers of thermo tolerant faecal coliforms were present. More recently this view was sustained by Drake^[16], Hoadly^[20], Cabelli, Kennedy and Levin^[7] and Jawed^[22], these workers had observed a higher incidence of this organism in heavily polluted water than in water in which the level of pollution was relatively low.

Sewage polluted water is often a common source

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of disease in man and animals^[12]. Several diseases from water borne pathogens outbreaks are due to the presence of drug resistant enteric pathogens carrying "R" factors which results in deaths due to failure of patients to respond to treatment with antibiotics^[2,18]. The distribution of antibiotic resistant bacteria in aquatic environment mainly in surface water has been investigated^[25,19] and the significance of polluted water as route for the spreading of the antibiotic resistance in the environment has been realized.

During recent years, the distribution of antibiotic resistant strains of Enterobacteriaceae in aquatic has been studied in different parts of the world^[19,5,26]. Only few reports are available on the antibiotic resistance among *Pseudomonas aeruginosa* strains isolated from various drinking water sources in India. Therefore, the present study was undertaken to see the antibiotic resistance of *Pseudomonas aeruginosa* from drinking water sources of Rewa city in Madhya Pradesh.

MATERIALS AND METHODS

The seven drinking water samples were collected from different places such as S1-Khanna Chowk, S2-Bus Stand, S3-Tatahati, S4- Hospital Chowk, S6-Municipal Water and S7-University Campus. The kind of water sources were tube wells except Municipal tap water (S6).

Isolation of *Pseudomonas aeruginosa* was done by the method described by Pandya et al., (1975). The confirmation of *P.aeruginosa* was done by the Oxdiase test and other biochemical tests described by Cappucienno et al.,^[8] and the strains were maintained in the nutrient agar medium with 8% dettol.

Antimicrobial sensitivity of *Pseudomonas aeruginosa*

Antibiotic disks: Antibiotic disks of seven antibiotics with following potency used Amikacin (30µg), Benzylpenicillin (10µg), Cefotaxime (30µg), Chloramphenicol (30µg), Gentamicin (10 µg), Streptomycin (10µg), Tetracycline (30µg) of each 6 mm. disk.

The antibiotic susceptibility patterns of isolated strains were determined by disk diffusion method^[3]. After overnight incubation period the zone diameter were measured. The results were then interpreted ac-

TABLE 1: Antimicrobial sensitivity of isolated *Pseudomonas aeruginosa* strains from drinking water sources of Rewa city

Water sample	Antibiotics						
S1	AK ^r	BP ^f	CE ^r	C ^s	G ^r	S ^s	T ^s
S2	AK ^{pr}	BP ^f	CE ^r	C ^s	G ^r	S ^s	T ^r
S3	AK ^s	BP ^f	CE ^r	C ^s	G ^r	S ^s	T ^{pr}

Antibiotics: Ak-Amikasin, BP-Benzylpenicillin, CE-Cefotaxime, C-Chloramphenicol, G-Gentamicin, S-Streptomycin, T-Tetracycline, S-sensitive, PR-Partial resistance, R-Resistance; Water samples: S1-Khanna chowk (Tube Well), S2-Bus stand (Tube well), S3-Tatahati (Tube well)

TABLE 2: Percentage of sensitivity, resistance and partial resistance of *Pseudomonas aeruginosa* drinking water isolates to various antibiotics

Antibiotics	sensitive (%)	Partial resistance (%)	Resistance
Amikacin	33.33	33.33	33.33
Benzylpenicillin	-	-	100.00
Cefotaxime	-	-	100.00
Chloramphenicol	100.00	-	-
Gentamicin	33.33	-	66.00
Streptomycin	100.00	-	-
Tetracycline	33.33	33.33	33.33

ording to the critical diameter prescribed by national committee for clinical Laboratory standard^[29].

RESULTS

Present study deals with antimicrobial sensitivity of various antibiotics against isolated *Pseudomonas aeruginosa*. Only three drinking water samples of S1, S2, S4, have given positive results for the presence of *Pseudomonas aeruginosa* and were subjected to antimicrobial sensitivity test against seven antibiotics. Antibiogram of *P.aeruginosa* water isolates is shown in TABLE 1 and percentage of sensitivity, partial resistance and resistance response shown in TABLE 2.

All the strains of *Pseudomonas aeruginosa* tested were resistance to Benzylpenicillin and Cefotaxime, among aminoglycosides 66.66% strains was found resistance to Gentamicin. In the case of other antibiotics 33.33% isolated strains were found partial resistance and showed resistance to Amikacin and Tetracycline. But all the strains were found sensitive to Chloramphenicol and streptomycine.

DISCUSSION

Multiple drug resistance of *P.aeruginosa* strains have been reported to β-lactum (Benzylpenicillin) anti-

biotics as observed in present study was also been reported earlier by S.Jain,^[21]. In the same way the strains were found resistance to Tetracycline in present study were also highly resistance reported earlier by chandler and Krishnapalli et al.,^[10]. Resistance to β -lactum antibiotics due to R-factors impart in the organism, the capacity of producing β -lactamase and induce some cell wall changes which result in making them resistant^[37]. Among aminoglycosides 66.6% strains were found resistance to Gentamicin in present study. But majority of strains were found sensitive in other workers^[21,13,10] observation. S.Jain^[21], reported that 96.8% strains were found sensitive to Amikacin, however in present study the strains observed resistance. Resistant to aminoglycoside antibiotics were due to their enzymatic inactivation^[28].

Dutta et al.,^[15] have reported that 83.3% to 95% strains were found resistance against Chloramphenicol. But in the Present study all the strains were found sensitive. Celma, Monro and Vezquez^[9] described the sensitivity to chloramphenicol due to the inhibition of protein synthesis process.

Majority of strains resistant to widely used amino glycosides likes Kanamycin and Streptomycin^[4,37,14,23]. But in the present study all the strains were observed sensitive to streptomycin sensitivity to streptomycin due to the inhibition of protein synthesis^[33].

Wide spread use of antibiotics with out professional could be one reasons in favoring the increased incidence of drug resistance bacteria in water^[17]. Studies of Kelch and Lee et al.^[24] suggest that water treatment could play selection process causing an increase in antibiotic resistance of bacteria in drinking water.

The incidences of antibiotic resistant strains vary significantly in water. No obvious connection with the water source or level of contamination has been reported. The incidence of resistance strains was found high in untreated domestic sewage and brakish water and lake water which were also found in ground water in present study.

The studies of Alkhar river (Baghdad) and various other studies show higher resistance in pollution indicator bacteria for Ampicillin, as Ampicillin is known to be common in sample of untreated sewage^[30]. However it was shown the clinical isolates of bacteria *P.aeruginosa* and *E.coli* in Baghdad^[1]. Simlar results also observed with Benzylpenicilline but *P.aeruginosa* strains

were isolated from contaminated ground water.

It is well known that misuse of antibiotics is a major factor affecting the emergence of antibiotic resistance in bacteria^[17].

CONCLUSION

This study may explain the emergency of antibiotic(s) resistant pollution indicator bacteria in the river water and underground water system.

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