

Study of Biofilm Production in *Escherichia coli* Causing Urinary Tract Infection

Dear Editor,

Urinary tract infections pose a serious health threat with respect to antibiotic resistance and high recurrence rates. *Escherichia coli* is the predominant organism causing urinary tract infections. Uropathogenic *E. coli* forms intracellular bacterial communities with many biofilm-like properties within the bladder epithelium.¹ These intracellular biofilm-like pods allow bacteria to outlast a strong host immune response to establish a dormant reservoir of pathogens inside the bladder cells. Re-emergence of bacteria from this reservoir might be source of recurrent infections.²

The present study was aimed at *in vitro* qualitative estimation of biofilm production in *E. coli* and correlates it with antibiotic resistance and surface hydrophobicity.

A total 50 strains of *E. coli* showing significant count ($>10^5$ cfu /mL) were isolated from cases of urinary tract infections. The organisms were identified by standard biochemical reactions. Antibiotic sensitivity test was performed by Kirby-Bauer disk diffusion method.³ The results are shown in table 1. Surface hydrophobicity was performed by salt aggregation test (SAT) of Lindahl *et al.*⁴

E. coli ATCC 25922 was used as control. Biofilm production was tested by microtitre plate method and quantitated spectrophotometrically using an ELISA Reader.⁵ Biofilm production was correlated with antibiotic resistance as well as surface hydrophobicity. Statistical analysis was performed by Kruskal-Wallis test and Mann Whitney U test.

Forty-six out of 50 strains of *E. coli* (92%) showed significant production of biofilm. Twenty-one out of 50 (54%) strains were sensitive to gentamicin followed by tobramycin (50%) and cotrimoxazole (44%) and ciprofloxacin (44%)

Multi-drug resistance pattern of the biofilm producing isolates is shown in Table 2.

Out of the total 50 strains of *E. coli* isolated, there was significant correlation between biofilm production and

Table 1: Antibiotic susceptibility results of the 50 <i>E. coli</i> isolates tested	
Antibiotic	Number (% sensitive) n=50
Amikacin	7 (14)
Ampicillin	10 (20)
Ceftazidime	18 (36)
Ciprofloxacin	22 (44)
Co-trimoxazole	22 (44)
Gentamicin	27 (54)
Nalidixic acid	9 (18)
Netillin	2 (4)
Norfloxacin	9 (18)
Tetracycline	9 (18)
Tobramycin	25 (50)

Table 2: The multidrug resistance pattern of Biofilm producing <i>E. coli</i>	
Multiple drugs combination	Number (%)
A,Co,Na,Nx	27 (54)
A,Na,Nx	7 (14)
Co,Na,Nx	2 (4)
A,Co,Na	2 (4)
A - Ampicillin, Co - Co-trimoxazole, Na - Nalidixic acid, Nx - Norfloxacin	

resistance to multiple antibiotics such as ampicillin (A), co-trimoxazole (Co), nalidixic acid (Na) and norfloxacin (Nx). 11 out of 50 strains of *E. coli* showed significant SAT values (> 1.4). These strains were found to show increased biofilm production.

Bacterial biofilms are often associated with long-term persistence of organisms in various environments. Bacteria in biofilm display dramatically increased resistance to antibiotics.² The present study also showed significant

correlation between biofilm production and multi-drug resistance.

Biofilm production in *E. coli* may promote colonization and lead to increased rate of urinary tract infections. Such infections may be difficult to treat as they exhibit multi-drug resistance. A greater understanding of the nature of intracellular bacterial communities in chronic or recurrent urinary tract infections will aid in the development of new and more effective treatments for these problematic diseases.

References

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