7. RECOMMENDATIONS AND FUTURE DIRECTIONS

Antimicrobial resistance is a growing major public health issue and a strong concern for the medical community. The present study depicts moderate occurrence of MDR (20.43%), XDR (11.83%) and PDR (2.15%) *P. aeruginosa* isolates. The occurrence of such multidrug resistant, extensive drug resistant and pan drug resistant strains is quite alarming with regard to antibiotic resistance. We must have to work towards preventing the emergence and spread of these multi-drug resistant, extensive drug resistant and pan drug resistant bacteria in hospital settings as well as in the community. We recommend piperacillin/tazobactum and levofloxacin as drug of choice for treating *P. aeruginosa* infections because lower frequency (9.6% and 7.53% respectively) of isolates resistant for these antimicrobial agents was observed.

In the present study, ESBL as a mechanism of antibiotic resistance was observed in 31.11% *P. aeruginosa* strains. This is probably the first report regarding the occurrence of ESBL strains in the state of Himachal Pradesh. The phenotypic detection of ESBL producing bacteria in laboratories is a vital step for appropriate management of *P. aeruginosa* infections, but genotypic identification of these enzymes provides essential information for infection prevention and control efforts. Genotypically, there is a predominant presence of *bla*\_TEM-1, *bla*\_CTX-M-15 and *bla*\_SHV-12 gene variants among ESBL producers in this region of the country. This study can be further extended to characterize other ESBL genes (*bla*\_GES, *bla*\_VEB, *bla*\_OXA, *bla*\_BES, *bla*\_TLA and *bla*\_PME) and a larger geographic area may also include to know the incidence of ESBL producing *P. aeruginosa* strains. This might be helpful in studying the epidemiology of such resistant strains in the country and could help in managing the infections due to them. This study may also be extended further to characterize ESBL encoding genes on the plasmid DNA, as we characterized ESBL genes present on the genomic DNA of *P. aeruginosa* strains.

Recent worldwide spread of ESBL producers into the community has been on increase. ESBL producing *P. aeruginosa* has become part of the flora in communities globally, making their eradication impossible. We have to fight this problem through the
development of diagnostic tools for their laboratory detection. We need to go one step ahead in the fight against microbial resistance because detection and identification is only a part of the fight. Appropriate use of antibiotics is more important than preventing infections caused by these resistant organisms in the community. On the local level, awareness of community by microbiologists and clinicians serving as a key to early detection and appropriate treatment of patients affected by such ESBL producing *P. aeruginosa*. This study might be useful to the clinicians for designing effective strategies to treat infections caused by ESBL producers. It would be useful in further preventing the infection in the state. Routine detection of ESBL producing isolates and proper control measures are recommended so that appropriate management can be done.