CONCLUSION

6.3 Conclusions and highlights of the study

Combating the increase in antibiotic resistance in bacteria is one of the most important therapeutic challenges that plague the treatment of hospital acquired infections. Unfortunately, approaching this challenge as an isolated etiology limits the solutions. This study further reiterates the need to consider the interdependence of both the regulation and transmission of antibiotic resistance and virulence among extended spectrum-β-lactamase (ESBL) producing bacteria. Higher bacterial virulence and the genetic mechanisms which lead to antibiotic resistance are closely associated with each other, and facilitate the bacteria to communicate through quorum sensing. The exchange, transfer, expression and regulation of these genes is very often facilitated when both genetic elements are present on the same plasmid and also when bacteria occur in a biofilm state. Naturally, the increased virulence evolves in response to or in tandem with greater antibiotic resistance. Thus, for a successful control of antibiotic resistance in bacteria, there is a pressing need to control the spread of virulence as well. This could be accomplished through new combination anti-virulence strategies against infection causing bacteria, which do not impose selective pressures of life or mortality. The present study has laid open several virulence determinants of *K. pneumoniae* isolated from various sites and their association with antibiotic resistance. This knowledge will pave way for better understanding of the regulation and its influence all determinants. This is very essential to develop newer therapeutic approaches that can ultimately tackle antibiotic resistance in bacteria through the genetic manipulation of the bacterial virulence determinants.

The present investigation also shows that, the multidrug resistant ESBL producing *Klebsiella pneumoniae* are still a gigantic problem in the hospital setup. ESBL producing *Klebsiella pneumoniae* infections are likely to affect critically ill patients who require prolonged hospitalization. Infections produced by the ESBL producers are also associated with adverse clinical outcome. Strict isolation of patients infected with ESBL producing *Klebsiella pneumoniae* and judicial use of antibiotics should be
emphasized in order to prevent the spread of infections of these isolates. Further, more clinical studies are needed to identify the risk factors for development of ESBL and to determine the economic impact of these infections, thereby to determine the most efficacious antimicrobial regimens and duration of therapy to maximize the outcome of patients with ESBL producing *K. pneumoniae* infections.

### 6.4 Limitations of the study

The drawback of the study is that, this study was able to detect the presence of only NDM-1 gene of the several MBL genes among the imipenem resistant isolates of *K. pneumoniae* because of which there are chances that, we could have missed out on the detection of other genes coding for carbapenamases. Detection of siderophores would have added up more importance along with other virulence factors, since they are one of the prominent iron chelating molecules that confer higher virulence to *K. pneumoniae* strains.

### 6.5 Scope for future work

This study highlights the greater association between virulence factors and ESBL production among clinical isolates of *K. pneumoniae*. Since many of these virulence factors and even antibiotic resistance is closely related to bacterial cross talk that occurs as a part of quorum sensing, for successful treatment of these infections it would be ideal to develop agents that can combat the most determining virulence factor such as quorum sensing among MDR and virulent bacteria.