Conclusion

β-lactam and quinolone antibiotics are the most important antimicrobial agents used for the treatment of Klebsiella infections. The inappropriate use of these antibiotics recently has led to the spread of multidrug resistance among Klebsiella isolates. An increase in resistance to β-lactam and quinolone antibiotics is a global threat to the empirical treatment of hospital acquired infections.

The rising trend of MDR seen over the successive years, is an alarming situation. In the present study, resistance to all tested fluoroquinolone antibiotics and MDR were found to be significantly higher in ESBL producing Klebsiella isolates. However, among the quinolones, the highest rate of resistance was observed for NA, CIP, MO, SPX, LEV. The MIC values of fluoroquinolone resistant strains were very high, so treatment with these antibiotics should be checked for their susceptibility by AST before prescribing.

The present study shows that biofilm production is an important virulence factor in Klebsiella infection. Biofilm production depends on physical and chemical factors like nature of the surface, composition of the medium and bacterial factors like type of strains, and the presence of fimbriae. Increased biofilm production was noticed among Klebsiella strains which are positive for mannose resistant haemagglutination. Biofilm producing strains of Klebsiella isolates exhibited increasing rate of antibiotic resistance. A new emerging hypermucoviscosity (HV) factor is noticed in the present study, more in pus and sputum samples, and the gene of HV, i.e., rmpA and magA were present in, not only phenotypically positive isolates, but also in phenotypically negative isolates. So to check this hypervirulent factor among Klebsiella infection, one has to rely on molecular technique.

Molecular analysis of this study showed that, ESBL producing K. pneumoniae isolates acquired from a tertiary care hospital in Karnataka, India, had high ESBL occurrence with predominant blaCTX-M type, and high frequency of PMQR genes. The aac(6')Ib-cr, oqxA, and oqxB genes were widely distributed among the K. pneumoniae isolates of the present study. The screening of ESBL producing K. pneumoniae for PMQR carriage could be helpful in both treatment and prevention of the spread of resistant strains.
This is the first study conducted in Karnataka, India, and shows dissemination of MDR and PMQR among ESBL producing *Klebsiella* isolates. Present study observed resistance among the *Klebsiella* isolates in this study to β-lactam and fluoroquinolone groups of antibiotics. Hence, therapeutic protocols with fluoroquinolone and β-lactam antibiotics, should be seriously revised.