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Isolation and Molecular Characterization of Lytic Bacteriophage against Carbapenem Resistant Klebsiella pneumoniae

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Abstract : Introduction: Klebsiella pneumoniae is a well-known opportunistic human pathogen, primarily causing healthcare-associated infections. The global emergence of carbapenemase-producing K. pneumoniaeis a major public health burden, which is often extensively multidrug resistant.Thus, because of the difficulty to treat these ‘superbug’ and menace and some term as ‘apocalypse’ of post antibiotics era, an alternative approach to controlling this pathogen is prudent and one of the approaches is phage mediated control and/or treatment. Objective: In this study, we aimed to isolate novel bacteriophage against carbapenemase-producing K. pneumoniaeand characterize for potential use inphage therapy. Material and Methods: Twenty lytic phages were isolated from river water using double layer agar assay and purified. Biological features, physiochemical characters, burst size, host specificity and activity spectrum of phages were determined. One most potent phage: Phage TU_Kle10O was selected and characterized by electron microscopy. Whole genome sequences of the phage were analyzed for presence/absence of virulent factors, and other lysin genes. Results: Novel phage TU_Kle10O showed multiple host range within own genus and did not induce any BIM up to 5th generation of host’s life cycle. Electron microscopy confirmed that the phage was tailed and belonged to Caudovirales family. Next generation sequencing revealed its genome to be 166.2 Kb. bioinformatical analysis further confirmed that the phage genome ‘did not’ contain any ‘bacterial genes’ within phage genome, which ruled out the concern for transfer of virulent genes. Specific 'lysin’ enzyme was identified phages which could be used as 'antibiotics'. Conclusion: Extensively multidrug resistant bacteria like carbapenemase-producing K. pneumoniaecould be treated efficiently by phages.Absence of ‘virulent’ genes of bacterial origin and presence of lysin proteins within phage genome makes phages an excellent candidate for therapeutics.

Keywords : bacteriophage, Klebsiella pneumoniae, MDR, phage therapy, carbapenemase,
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