Prevalence and Molecular Epidemiology of ESBL producing E. coli and K. pneumoniae in Lebanese Medical Centers; Strong Correlation between Antibiotic Consumption and Resistance to Cephalosporins and Ciprofloxacin

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Background

Extended-spectrum β-lactamase (ESBL)-producing Escherichia coli and Klebsiella pneumoniae have rapidly spread worldwide creating a severe threat for patients. The development of resistance in these bacteria is multi-factorial; antibiotic consumption is a major factor in this context. In view of both significant increase in ESBL production and lack of efficient control of antibiotic use in Lebanon (Middle East), we conducted a study to determine the epidemiology of ESBL-related genes in E. coli and K. pneumoniae, and analyzed the correlation of antibiotic use with bacterial resistance in three major medical centers located in different areas of the country.

Methods

Three medical centers located in the north, south, and the capital (Beirut) of Lebanon were chosen for this study. All ESBL producing E.coli and K.pneumoniae from inpatients were collected between 1/2012 and 1/2013. Only the first isolate per patient was included. Antibiotic consumption was expressed in DDD/100 bed days (bd) and Kirby-Bauer technique was used for antibiotic resistance testing. For the phenotypic detection of ESBL, double disk synergy test and E-test were performed. PCR and multiplex PCR were used for the detection of the genes blaTEM, blaSHV, blaCTX-M and blaOXA. The identification of blaCTX-M9 was done by sequencing of the gene. The association between consumption and resistance was analyzed using Spearman correlation coefficient. Pulsed Field Gel Electrophoresis (PFGE) was used to determine the clonality of the different isolates.

Results

A total of 1002 E.coli and 233 K.pneumoniae isolates were analyzed. 29.9% of E.coli strains and 31.1% of K.pneumoniae were ESBL producers. Correlation data showed strong significance between the use of 3rd and/or 4th generation cephalosporins and resistance to these antibiotics. In addition, the correlation factor of cephalosporin consumption versus susceptibility to ciprofloxacin in E.coli (Hospital 1) was as low as -0.899 and -0.886 in K. pneumoniae (Hospital 3). blaCTX-M9 was produced by 97% of E.coli and 96.7% of K.pneumoniae. Specifically, blaCTX-M9 was commonly found. 22.3% of E.coli and 37.4% of K.pneumoniae co-produced the 4 studied beta-lactamas. Pulsed-field gel electrophoresis analysis demonstrated that there was no major clonal relationship among these ESBL producers.

Conclusions

Our data show the urgent need for antimicrobial stewardship programs in the country to control the use of antibiotic and the spread of bacterial resistance.

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