The prevalence and antimicrobial sensitivity of *Esbl Escherichia Coli* in clinical isolates

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ABSTRACT
Background: The antimicrobial resistance is one of the most serious and expanding health problems world-wide in the last decades. The esbl escherichia coli. (extended-spectrum beta-lactamase e.coli) represents an important aspect of it.

Objectives: To get an overview on the esbl e.coli prevalence profile in general. Also to assess the antibiotic sensitivity of esbl e. coli trying to specify the most effective antibiotics in combating this micro-organism.

Methods: this study tries to focus on this problem in Iraq which through a prospective study approach by taking 35 clinical samples from various sources (urine, blood, abscess, eye, vagina, stool and others), and after confirming the presence of e. coli the presence of esbl e. coli and antibiotic sensitivity are confirmed by the use of Kirby-bauer method.

Results: results showed that esbl e.coli constitutes 80% of the cases, while the results of antibiotic sensitivity were as follows: ampicillin 3.3%, ampicillin/subbactam 20%, amoxi/clav 0%, pipracillin/tazobactam 89.7%, meropenem 96.7%, imipenem 96.9%, cefotaxime 0%, ceftiraxone 11.8%, cefazidime 16.1%, cefipime 14.3%, cefazolin 16.1%, cefoxitin 64.7%, aztreonam 14.3%, gentamycin 50%, tobramycin 64.3%, amikacin 94.3%, ciprofloxacin 58.8%, levofloxacin 64.5%, nitrofurantoin 79.2%, trimethprim/sulpha methoxazole 29.6%.

Conclusion: the problem of esbl e. coli is expanding and there is a continuous demand for frequent monitoring of the new trends on antimicrobial resistance in different parts of the world in addition to trying to develop new antimicrobials to combat the new highly resistant strains. Moreover there is a continuous need to educate the medical and the paramedical staff about the risk of unjustified and improper prescription of antimicrobials.

Key words: escherichia coli, extended-spectrum beta-lactamase, kirby-bauer method, muller hinton agar

Al-Kindy College Medical Journal 2014: Vol.10 No. 2 Pages: 96-99

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Received 10th Nov 2014, accepted in final 20th April 2015
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Extended-spectrum B-lactamase producing (esbl) clinical isolates among members of the enterobacteriaceae family, especially klebsiella pneumoniae and escherichia coli, represent one of the most important world problems of b-lactam antimicrobial resistance. Beta-lactamases are enzymes produced by some bacteria and are responsible for their resistance to beta-lactam antibiotics like penicillins, cephamycins, and carbapenems (ertapenem). (cephalosporins are relatively resistant to beta-lactamase.) these antibiotics have a common element in their molecular structure: a four-atom ring known as a lactam ring. these enzymes deactivating the molecule's antibacterial properties. in the mid-1980s, a new group of enzymes, the extended-spectrum b-lactamase (esbls), was detected (first detected in Germany in 1983)3.

The esbls are frequently plasmid encoded. plasmids are responsible for esbl production frequently carry genes encoding resistance to other drug classes (for example, aminoglycosides). therefore, antibiotic options in the treatment of esbl-producing organisms are extremely limited. carbapenems are the treatment of choice for serious infections due to esbl-producing organisms, yet carbapenem-resistant isolates have recently been reported4.

The correct identification of esbl-producing bacteria has important clinical-epidemiological and laboratory implications. First, patients may experience a delay in appropriate treatment if esbl-producing bacteria are not correctly detected by routine antimicrobial susceptibility tests. Second, while carbapenems are the most effective therapy for esbl bacterial infections, their routine use can select resistant strains, as the emergence of imipenem-resistant acinetobacterbaumanni, pseudomonas aeruginosa and k. pneumoniae. Third, esbl genes are located on large plasmids that can harbor genes for resistance to other non-b-lactams antibiotics, and therefore, esbl-producing bacteria often exhibit multidrug-resistant phenotypes, reducing the drug arsenal even further. Fourth, genes encoding esbls are typically located in conjugal plasmids or integron-like structures and can be effectively transferred to other strains and species. Finally, esbl-producing organisms, especially k. pneumoniae, but also e. coli, have been responsible for serious nosocomial infection outbreaks that lead to prolonged hospital stay, increased morbidity and mortality, and consequently increase healthcare associated costs.

The objectives of this study were to get an overview on the esbl e.coli prevalence profile in general. Also to assess the antibiotic sensitivity of esbl e. coli trying to specify the most effective antibiotics in combating this micro-organism.

Methods. a prospective study in which e.coli isolates are taken from various clinical samples from patients in al-khadimiya teaching hospital. These isolates are confirmed as being e.coli by microscopy which shows gram-negative rods, with no particular cell arrangement. Then, by macconkey agar is inoculated. on macconkey agar, deep red colonies are produced, as the organism is lactose-positive, and fermentation of this sugar will cause the medium's ph to drop, leading to darkening of the medium. if the isolates shows to be positive for e.coli then the antibiotic susceptibility and the presence of esbl e.coli is assessed using the disk diffusion susceptibility testing (kirby-bauer method) by inoculation of isolates into muller hinton media and applying the antibiotic disks: the antibiotics disks used are listed ampicillin, amoxiclav,
ampicillin/sulbactam, meropenem, imipenem, piperacillin/tazobactam, aztreonam, cefazolin, cefotaxime, ceftazidime, cefotaxime, cefoxitin, cefepime, amikacin, gentamycin, tobramycin, ciprofloxacin, levofloxacin, nitrofurantoin, and trimethoprim/sulphamethoxazole.

After incubation at 35°C for 24 h, zone of inhibition size is measured. Then these results (zones of inhibition) were interpreted according to the standards proposed by (performance standards for antimicrobial susceptibility testing; twenty-first informational supplement 2011).

The prevalence of ESBL E.coli and the antibiotic sensitivity are demonstrated by using percentages to show which antibiotics are better in combating the ESBL E.coli.

**Results.** Various clinical samples (total number =35) were collected in AL-Khadimiya teaching hospital and after implementing the above methods the results were as follows: number of males =14, number of females =21, male to female ratio=0.66.

**Discussion.** The prevalence of ESBL E.coli is higher among females in this study and this can be due to that most of the isolates of the E.coli were obtained from urine samples (57%) and the most abundant micro-organism in UTI in general is E.coli, which when added to vaginal swab samples, both together represent 65% of the cases, in addition to the fact that UTI is more abundant among females.

The prevalence of ESBL E.coli is very high in these samples (80%) which is similar to a study done in India in 2011 (80.64%) in another study done in Spain in 2011 the prevalence of ESBL E.coli was 70%. This variation can be attributed to the different methods used in that study which comprised the use of PCR-based replicon-typing scheme. By comparing the results of the present study with those done several years ago in different countries around the globe, we can notice the great increase in the prevalence of ESBL E.coli. E.g. in a study done in Latin America (smart) in 2003 the prevalence rate was 10%, in 2004 also 10% and in 2008 was 26%.

In addition to these differences with respect to time, there are differences that are related to geographic locations. In a study done in different parts of the world showed that in south America 18.1% of E.coli were ESBL positive, while only 7.5% of isolates from north America were ESBL positive.

**Figure 1:** Sources of clinical isolates.

**Figure 2:** Prevalence of ESBL+VE E.COLI

**Figure 3:** The antimicrobial sensitivity of ESBL+VE E.COLI
Regarding the antimicrobial sensitivity of *E. coli* isolates in my study they were as follows:

1. ampicillin 3.3%, in comparison to a study done in China (2011) the sensitivity was 17.7%.
2. ampicillin/sulbactam 20%, compared to a study done in (2008) Latin America the sensitivity was 2.2%.
3. amoxi/clav 0%, in a study done in Switzerland (2011) the sensitivity was 30.4%.
4. piperacillin/tazobactam 89.7%, compared to a study done in Sweden (2011) the sensitivity was 91%, compared to a study done in Italy (2010) the sensitivity was 63.2%.
5. meropenem 96.7%, compared to a study done in China (2011) the sensitivity was 100%, compared to a study done in Italy (2010) the sensitivity was 100%
6. imipenem 96.9%, compared to a study done in China (2011) the sensitivity was 100%, also confirmed by a study done in Pakistan (2011) which showed 100% sensitivity.
7. cefotaxime 0%, compared to a study done in Sweden (2011) the sensitivity was 1%, while a study done in Pakistan (2011) the sensitivity was 11%.
8. ceftriaxone 11.8%, compared to a study done in China (2011) the sensitivity was 3.2%.
9. ceftazidime 16.1%, compared to a study done in Sweden (2011) the sensitivity was 9%
10. cefpirme 14.3%, compared to a study done in Spain (2011) the sensitivity was 14.7%, while a study done in Pakistan (2011) the sensitivity was 13%
11. cefazolin 16.1%, compared to a study done in China (2011) the sensitivity was 1.6%, compared to a study done in Canada (2008) the sensitivity was 79.9%.
12. cefoxitin 64.7%, while a study done in Pakistan (2011) the sensitivity was 60%, compared to a study done in Turkey (2008) the sensitivity was 100%.
13. aztreonam 14.3%, compared to a study done in China (2011) the sensitivity was 31.2%, compared to a study done in Romania (2010) the sensitivity was 3.6%.
14. gentamycin 50%, compared to a study done in China (2011) the sensitivity was 49%
15. tobramycin 64.3%, compared to a study done in South (2008) the sensitivity was 49%
16. amikacin 94.3%, compared to a study done in Spain (2011) the sensitivity was 75.9%, while compared to a study done in Brazil (2011) the sensitivity was 81%.
17. ciprofloxacin 58.8%, compared to a study done in China (2011) the sensitivity was 47.1%, compared to a study done in Spain (2011) the sensitivity was 75.5%
18. evofloxacin 64.5%, compared to a study done in Brazil (2011) the sensitivity was 50.8%, while compared to a study done in Taiwan (2009) the sensitivity was 64%
19. nitrofurantoin 79.2%, compared to a study done in Sweden (2011) the sensitivity was 93%.
20. trimethprine-sulphamethoxazole 29.6%, compared to a study done in Sweden (2011) the sensitivity was 30%

The results above show that the most effective antibiotics in treating ESBL *E. coli* are imipenem, meropenem, piperacillin/tazobactam, and amikacin.

In conclusion, the problem of ESBL *E. coli* is expanding and needs to be followed in terms of continuous monitoring of the new trends on antimicrobial resistance in addition to trying to develop new antimicrobials to combat the new highly resistant strains. Moreover, there is a continuous demand to educate the medical and the paramedical staff about the risk of unjustified and improper prescription and use of antimicrobials.

References:
1. WHO. Chronic supplicative otitis media. Geneva. Switzerland; 2004;9
3. Alan E Dugdale. Management of chronic supplicative otitis media. MAJ; 2004; 180 (2): 91-93
29. AS Adoga et al. Swab and aspiration specimen collection methods and antibiogram in chronic suppurative otitis media at Jos University Teaching Hospital: Which is superior? Department of Surgery, Ear, Nose and Throat unit, Jos University Teaching Hospital, Ibadan, Nigeria. 2010; 9(4): 230-234.