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/sulbactam 20% , amoxi/clav 0%pipracillin/tazobactam 89.7% meropenem 96.7% ,imipenem 96.9% ,cefotaxime 0% ,ceftriaxone 11.8%,ceftazidime 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%,trimethprimesulpha 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 abot the risk of unjustified and improper prescription and use of antimicrobials.

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

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Extended - spectrum B-lactamase producing (esbl) clinical isolates among members of the entero bacteriaceae family, especially *klebsiella pneumoniae* and *escherichia coli,* represent one of the most important world problems of b-lactam antimicrobial resistance.[1]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 beta-lactam. the lactamase enzyme breaks that ring open, deactivating the molecule's antibacterial properties.[2] 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 reported[4].

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.[5] 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 *acinetobacterbaumanii*, *pseudomonas aeruginosa* and *k. pneumoniae*.[6,7]. 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[8]. Fourth, genes encoding esbls are typically located in conjugative plasmids or integron-like structures and can be effectively transferred to other strains and species[9].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[10].

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[11]. 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, piracillin/tazobactam, aztreonam, cefazolin, cefotriaxone, ceftazidime, cefotaxime, cefoxitin, cefepime, amikacin, gentamycin, tobramycin, ciprofloxacin, levofloxacin, nitrofurantoin, and trimethoprime /sulpham ethoxazole.

After incubation at 35c for 24 h, zone of inhibition size is measured[12]. Then these results (zones of inhibition) were interpreted according to the standards proposed by (performance standards for anti microbial susceptibility testing; twenty-first informational supplement 2011)[13].

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 utiin general is *e.coli*[14],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[15].

The prevalence of esbl*e.coli* is very high in these samples (80%) which is similar to a study done in Indiain 2011 (80.64%)[16]. in another study done in Spainin 2011 the prevalenc of esbl*e.coli* was 70%[17]. this variation can be attributed to the different method 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% [18],in 2004[19] also 10% and in 2008 was 26%[20].

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 America18.1% of *e.coli*were esbl positive, while only 7.5% of isolates from north America were esbl positive[21].

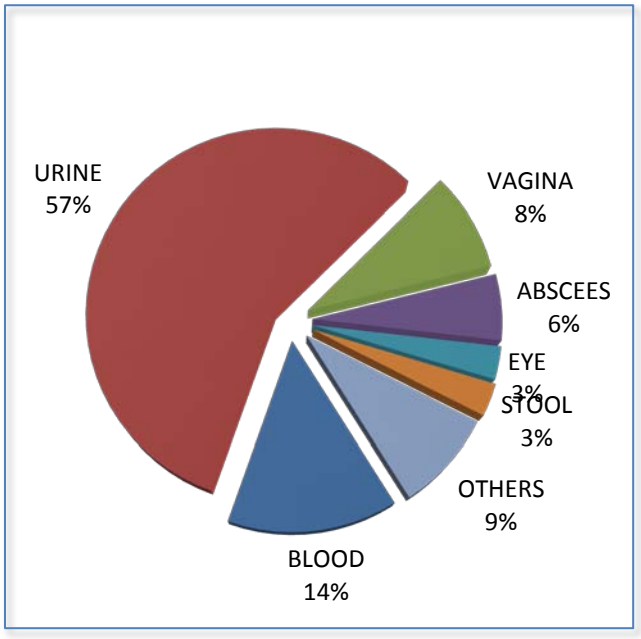

Figure 1: Sources of clinical isolates.

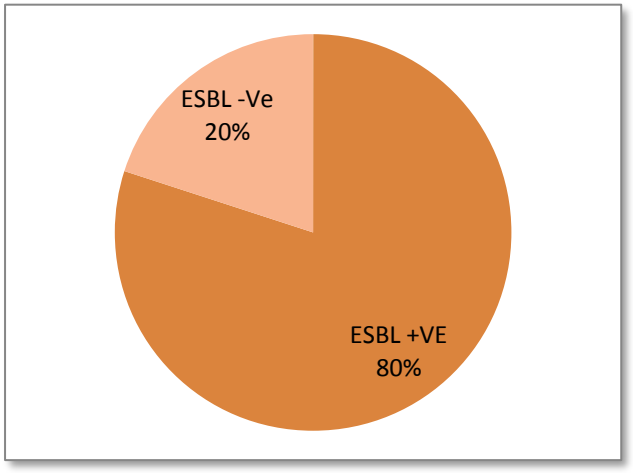

Figure 2: Prevalence of ESB+VE E.COLI

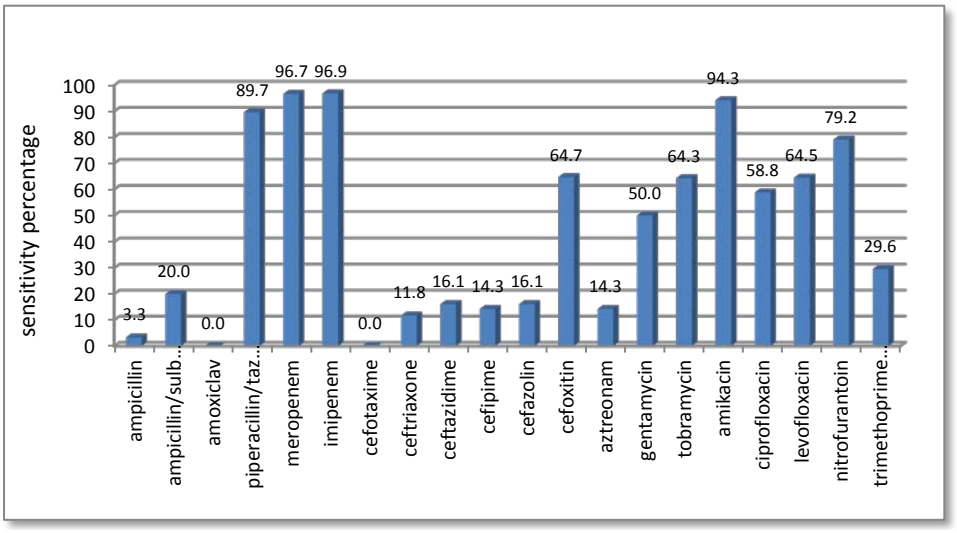

Figure 3: The antimicrobial sensitivity of ESBL+VE.E COLI

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% [22]
2. ampicillin/sulbactam 20% ,compared to a study done in (2008) latin America the sensitivity was 2.2% [23]
3. amoxi/clav 0% , in a study done in Switzerland(2011) the sensitivity was 30.4%[24].
4. pipracillin/tazobactam 89.7% ,compared to a study done in Sweden (2011) the sensitivity was 91%[25],compared to a study done in Italy (2010) the sensitivity was 63.2%[26]
5. meropenem 96.7% ,compared to a study done in china (2011) the sensitivity was 100%22,compared to a study done in Italy (2010) the sensitivity was 100%26
6. imipenem 96.9% ,compared to a study done in china (2011) the sensitivity was 100%22,also confirmed by a study done in Pakistan (2011) which showed 100% sensitivity[27].
7. cefotaxime 0% ,compared to a study done in Sweden (2011) the sensitivity was 1%25while a study done in Pakistan (2011) the sensitivity was 11%27
8. ceftriaxone 11.8%,compared to a study done in china (2011) the sensitivity was 3.2 %22
9. ceftazidime 16.1%, compared to a study done in Sweden (2011) the sensitivity was 9%25
10. cefipime 14.3% ,compared to a study done in Spain(2011) the sensitivity was 14.7% [28]while a study done in Pakistan (2011) the sensitivity was 13%27
11. cefazolin 16.1%%,compared to a study done in china (2011) the sensitivity was 1.6 % 22,compared to a study done in canada (2008) the sensitivity was 79.9% [29].
12. cefoxitin 64.7%, while a study done in Pakistan (2011) the sensitivity was 60%27, compared to a study done in turkey (2008) the sensitivity was 100%[30]
13. aztreonam 14.3%,compared to a study done in china (2011) the sensitivity was 31.2 %22,compared to a study done in romania (2010) the sensitivity was 3.6% [31]
14. gentamycin 50% ,compared to a study done in china (2011) the sensitivity was 49 %22
15. tobramycin 64.3%compared to a study done in south (2008) the sensitivity was 49 %[32]
16. amikacin 94.3% ,compared to a study done in Spain(2011) the sensitivity was 75.9%28,while compared to a study done in brazil (2011) the sensitivity was 81%[33]
17. ciprofloxacin 58.8% ,compared to a study done in china (2011) the sensitivity was 47.1 %22,compared to a study done in Spain(2011) the sensitivity was 75.5%28.
18. evofloxacin64.5% ,compared to a study done in brazil (2011) the sensitivity was 50.8%34,while compared to a study done in Taiwan (2009) the sensitivity was 64%[34]
19. nitrofurantoin 79.2% ,compared to a study done in Sweden (2011) the sensitivity was 93%25in a study done in Switzerland (2011) the sensitivity was 85%%24
20. trimethprime-sulphamethoxazole 29.6%,compared to a study done in Sweden (2011) the sensitivity was 30%25,compared to a study done in Spain(2011) the sensitivity was 30.1%28 the variations mentioned above in results can be attributed to differences in geographic location and time and sometimes to different methods.

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.

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