



# Extended Spectrum Beta Lactamase Production and Antibiotic Susceptibilities of Escherichia Coli Strains

## Escherichia Coli Suşlarının Genişlemiş Spektrumlu Beta Laktamaz Üretimleri ve Antibiyotik Duyarlılık Oranları

E. Coli Suşlarında Antibiyotik Duyarlılıkları / Antibiotic Susceptibilities of E. Coli Strains

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### Özet

**Amaç:** Bu çalışmada Tavsanlı Devlet Hastanesi Mikrobiyoloji Laboratuvarı'na gönderilen çeşitli klinik örneklerden izole edilen Escherichia coli suşlarının antibiyotik duyarlılıkları retrospektif olarak incelenmiş, bu mikroorganizmaların genişlemiş spektrumlu beta laktamaz (GSBL) üretimlerinin belirlenmesi amaçlanmıştır. **Gereç ve Yöntem:** Kültürlerin tümü etken ve antibiyotik duyarlılıkları açısından irdelenmiştir. Bakterilerin tanımlanmasında çeşitli biyokimyasal testler ve BBL Crystal E/NF (Beckton Dickinson, ABD) sistemi kullanılmıştır. Antibiyotik duyarlılığı Müller-Hinton Agarda disk difüzyon yöntemi ile CLSI kriterleri doğrultusunda değerlendirilmiştir. GSBL üretiminin araştırılması için çift disk sinerji yöntemi kullanılmıştır. **Bulgular:** Klinik örneklerden izole edilen 456 E. coli suşu çalışmaya dahil edilmiştir. E. coli suşları gönderildiği örnek türüne göre değerlendirildiğinde en fazla idrar örneğinden izole edildiği görülmektedir. E. coli suşlarının en fazla duyarlı oldukları antibiyotiklerin imipenem, amikasin ve sulbaktam/sefoperazon oldukları belirlenmiştir. Duyarlılığın en düşük olduğu antibiyotik ise ampisilindir. GSBL üretim oranı E. coli'de %15 olarak tespit edilmiştir. **Sonuç:** Tedavisi pahalı ve güç enfeksiyonlara neden olan, GSBL üreten E. coli ve diğer Gram negatif enterik bakterilerin GSBL üretim oranları, her merkez tarafından izlenmeli, tedavide tercih edilen geniş spektrumlu beta laktam antibiyotikler dikkatlice kullanılmalı, yatan hastalar izole edilmeli, risk altındaki bölümlerinde süreyans çalışması yapılmalıdır.

### Anahtar Kelimeler

Escherichia Coli, Antibiyotik Duyarlılığı, Genişletilmiş Spektrumlu Beta Laktamaz

### Abstract

**Aim:** In this study it was aimed to investigate the antibiotic susceptibilities and extended spectrum beta lactamase production of Escherichia coli strains isolated from various clinical samples sent to Tavsanlı State Hospital Microbiology Laboratory retrospectively. **Material and Method:** All of the cultures were examined for the agent and antibiotic susceptibilities. For the identification of bacteria, various chemical tests and BBL Crystal E/NF (Beckton Dickinson, ABD) system was used. Antibiotic susceptibilities were investigated according to CLSI criteria on Mueller Hinton agar by disc diffusion method. Double disc synergy method was used to investigate extended spectrum beta lactamase (ESBL) production. **Results:** 456 E. coli strains isolated from clinical samples were included in the study. E. coli strains were mostly isolated from urine according to clinical samples. The most effective antibiotics against E. coli strains were imipenem, amikacin and sulbactam/cefoperazone. The least susceptibility was against ampicillin. ESBL production rate was found to be %15 in E. coli. **Discussion:** ESBL producing E. coli which are the reason of expensive therapy and difficulties in treatment of infections should be monitored for ESBL production ratios by all of the centers, extended spectrum beta lactam antibiotics should be used carefully in treatment, hospitalized patients should be isolated and surveillance should be done in the units under risk.

### Keywords

Escherichia Coli, Antibiotic Susceptibilities, Extended Spectrum Beta Lactamase

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## Introduction

Resistant bacteria are the reason of many hospital and community acquired infections which lead to morbidity and mortality. Resistance against beta-lactam antibiotics are increasing all over the world including our country [1-3]. Bacteria gain the resistance by producing beta-lactamases against this group of antibiotics. Beta-lactamase enzyme leads to resistance against penicillines, 1st generation cephalosporines. These enzymes may be chromosomal or plasmid mediated [4,5]. Extended spectrum beta lactamases (ESBL) hydrolyses extended spectrum cephalosporins. They arise by mutations in genes for common plasmid mediated beta lactamases that alter the configuration of the enzyme near its active site to increase the affinity and hydrolytic ability of beta lactamases for oxyimino compounds while simultaneously weakening the overall enzyme efficiency (6) Hospitals are the most suitable places for these resistance genes to be selected and spread [7]. Hospital infection epidemics are seen because of the strains producing extended spectrum beta-lactamases which lead to problems in antibiotherapy [8]. Double disc synergy is a simple and low cost method to determine the presence of extended spectrum beta-lactamase [9]. In this study it was aimed to investigate the antibiotic susceptibilities and extended spectrum beta lactamase production of Escherichia coli strains isolated from miscellaneous clinical samples sent to Tavsanlı State Hospital Microbiology Laboratory retrospectively.

## Material and Method

In this study microbiological samples sent to Tavsanlı State Hospital Microbiology Laboratory between November 2009 and December 2011 were evaluated. All of the cultures were examined for the agent and antibiotic susceptibilities. For the identification of bacteria, various chemical tests and BBL Crystal E/NF (Beckton Dickinson, ABD) system was used. Antibiotic susceptibilities were investigated according to CLSI criteria on Mueller Hinton agar by disc diffusion method. Double disc synergy method was used to investigate extended spectrum beta lactamase (ESBL) production [9].

## Results

Of the 3651 samples sent to laboratory, 877 culture positive samples were evaluated. 456 of culture positive samples were identified as E. coli. 456 E. coli strains were included in the study (Table 1). E. coli was the most common (%52) isolated bacteria. E. coli strains were mostly isolated from urine according to clinical samples. Antibiotic susceptibilities of E. coli strains are shown in Table 2. The most effective antibiotics against E. coli strains were imipenem(%99), sulbactam/cefoperazone(%99) and amikacine (%96). The least susceptibility was against ampicillin(%28). ESBL production rate was found to be %15 in E. coli.

Table 1. Distribution of E. coli strains isolated from various clinical samples (TAS: Tracheal aspirate)

	E.coli (n=456)	ESBL + E.coli (n=68)
Urine	291	46
TAS/Sputum	65	10
Wound	51	7
Others	49	6
Total	456	68

Table 2. Antibiotic susceptibilities of E. coli strains (AMC: Amoxicillin/clavulonate, CES: Sulbactam/cefoperazone, SXT: Trimethoprim/sulfamethoxazole, ESBL: Extended spectrum beta lactamase)

Antibiotic	E.coli(n=456) %	ESBL + E.coli(n=68) %
Ampicillin	28	0
AMC	67	0
SXT	59	0
Cefazolin	62	0
Cefuroxime	67	0
Ceftriaxone	70	0
Ceftazidime	70	0
CES	99	94
Gentamicin	77	50
Amikacin	96	82
Ciprofloxacin	68	46
Imipenem	99	94

ESBL production rate was found to be %15 in E. coli.

## Discussion

Wide spectrum beta-lactam antibiotics are frequently used because of their bactericidal effect. But the common usage of this group of antibiotics leads to increasing amount of resistant strains [3,10]. In this reason, determination of ESBL activity by routine simple methods is important for the treatment of these infections. ESBL producing strains lead to increase in mortality and severe economical deficits [11].

Albayrak et al.[2] showed that the ESBL activity was found to be %19 in E. coli strains. Guducuoglu et al. [12] evaluated the samples according to the origin as polyclinics or clinics and showed the ESBL activity as %18 and %47 respectively in E. coli strains. Eryilmaz et al.[13] showed that the ESBL activity in E. coli strains were seen in %18. Mumcuoglu et al. [3] found the ESBL activity in E. coli strains to be %20. Bayramoglu et al.[14] found the ESBL activity in %6 of the E.coli strains. Studies evaluating the ESBL activity in our country show that the resistance rates are increasing in time [2,3,12,13].

Halina et al. [15] evaluated 1164 clinical samples in a pediatric group of patients. 585 Gram negative rods were isolated and 229 (%39) of them were found to have ESBL activity by the double disc synergy method. ESBL activity was found to be %30 in E. coli strains. It was thought that the reason for the high activity of ESBL resulted from the selected group of patients included in the study.

In different studies outside our country, ESBL activity was found to be between %5 and 25 by different methods in E. coli strains [16-18].

Treatment of resistant strains with new generation antibiotics can increase the cost of the drug up to ten folds or more (19). The cost of extra hospitalization resulting from infections with resistant organisms costs about 1,2 billion U.S. dollars in U.S.A. (20).

ESBL activity rates in E. coli strains (%15) in our hospital are similar to those obtained from national and international studies. This study also reveals that the most effective antibiotics against E. coli are imipenem, amikacine and sulbactam/cefoperazone. These antibiotics should not be used routinely, should be reserved for multi-drug resistant bacteria [21].

ESBL producing E. coli which are the reason of expensive therapy and difficulties in treatment of infections should be monitored for ESBL production ratios by all of the centers, extended spectrum beta lactam antibiotics should be used carefully in treatment, hospitalized patients should be isolated and surveillance should be done in the units under risk.

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