INdIAN JOURNAL OF MEDICAL MICROBIOLOGY
(Official publication of Indian Association of Medical Microbiologists,
Published quarterly in January, April, July and October)
Indexed in Index Medicus/MEDLINE/PubMed, ‘Elsevier Science - EMBASE’, ‘IndMED’

EDIToRIAL BOARD

EDITOR
Dr. SAVITRI SHARMA
L V Prasad Eye Institute
Bhubaneswar - 751 024, India

ASSOCIATE EDITOR
Dr. Shobha Broor
Professor, Department of Microbiology
All India Institute of Medical Sciences
New Delhi - 110 029, India

ASSISTANT EDITOR
Dr. V Lakshmi
Professor and Head, Dept. of Microbiology
Nizam’s Institute of Medical Sciences
Punjagutta, Hyderabad - 500 082, India

Dr. Reba Kanungo
Professor and Head
Department of Microbiology, Perunthalaivar Kamaraj Medical College and Research Institute, Kadhirkamam,
Puducherry - 605 009, India

ASSISTANT EDITOR
Dr. P Sugandhi Rao
Professor
Department of Microbiology
Kasturba Medical College
Manipal - 576 119, India

Dr. Reba Kanungo
Professor and Head
Department of Microbiology, Perunthalaivar Kamaraj Medical College and Research Institute, Kadhirkamam,
Puducherry - 605 009, India

MEMBERS

National

Dr. Arora DR (Rohtak)
Dr. Arunaloke Chakrabarthy (Chandigarh)
Dr. Camilla Rodrigues (Mumbai)
Dr. Chaturvedi UC (Lucknow)
Dr. Hemashettar BM (Belgaum)
Dr. Katoch VM (Agra)
Dr. Madhavan N (Chennai)
Dr. Mahajan RC (Changigarh)
Dr. Mary Jesudasan (Thrissur)
Dr. Meenakshi Mathur (Mumbai)
Dr. Nancy Malla (Changigarh)
Dr. Philip A Thomas (Tiruchirapally)
Dr. Ragiini Macaden (Bangalore)
Dr. Ramesh K Aggarwal (Hyderabad)
Dr. Renu Bhardwaj (Pune)
Dr. Sarman Singh (New Delhi)
Dr. Seyed E Hasnain (Hyderabad)
Dr. Sitaram Kumar M (Hyderabad)
Dr. Sridharan G (Vellore)
Dr. Sritharan V (Hyderabad)
Dr. Subhas C Parija (Pondicherry)

International

Dr. Arsekularatne SN (Srilanka)
Dr. Arvind A Padhye (USA)
Dr. Chinnaswamy Jagannath (USA)
Dr. Christian L Coles (USA)
Dr. David WG Brown (UK)
Dr. Diane G Schwartz (USA)
Dr. Govinda S Visveswara (USA)
Dr. Kailash C Chadha (USA)
Dr. Madhavan Nair P (USA)
Dr. Madhukar Pai (Canada)
Dr. Mohan Sopori (USA)
Dr. Paul R Klatser (Netherlands)
Dr. Vishwanath P Kurup (USA)

ADVISORY BOARD

Dr. KB Sharma (New Delhi), Dr. NK Ganguly (New Delhi), Dr. SP Thyagarajan (Chennai),
Dr. R Sambasiva Rao (New Delhi), Dr. MK Lalitha (Chennai), Dr. PG Shivananda (Manipal)

Annual Subscription Rs 2,000/- US $ 150
Single Copy Rs 600/- US $ 75

Editorial Office: LV Prasad Eye Institute, Patia, Bhubaneswar - 751 024, Orissa, India
Ph: (+91)-0674-3987 209, 099370 37298, Fax: (+91)-0674-3987 130, E-mail: ijmm@bei-lvpei.org, Website: www.ijmm.org

Published by MEDKNOW PUBLICATIONS
A-109, Kanara Business Center, Off Link Rd, Ghatkopar (E), Mumbai - 400075, INDIA
Phone: 91-22-6649 1818/1816, Fax: 91-22-6649 1817 • E-mail: publishing@medknow.com, Web: www.medknow.com

The journal is printed on acid free paper.
## CONTENTS

### Guest Editorial

**The Need for Control of Viral Illnesses in India: A Call for Action**  
C Lahariya, UK Baveja  
...... 309

### Review Article

**Immunobiology of Human Immunodeficiency Virus Infection**  
P Tripathi, S Agrawal  
...... 311

### Special Articles

**Serum Levels of Bel-2 and Cellular Oxidative Stress in Patients with Viral Hepatitis**  
HG Osman, OM Gabr, S Lotfy, S Gabr  
...... 323

**Rapid Identification of Non-sporing Anaerobes using Nuclear Magnetic Resonance Spectroscopy and an Identification Strategy**  
S Menon, R Bharadwaj, AS Chowdhary, DV Kaundinya, DA Palande  
...... 330

### Original Articles

**Species Distribution and Physiological Characterization of *Acinetobacter* Genospecies from Healthy Human Skin of Tribal Population in India**  
SP Yavankar, KR Pardesi, BA Chopade  
...... 336

**Extended-spectrum Beta-lactamases in Ceftazidime-resistant *Escherichia coli* and *Klebsiella pneumoniae* Isolates in Turkish Hospitals**  
S Hosoglu, S Gundes, F Kolayli, A Karadenizli, K Demirdag, M Gunaydin, M Altindis, R Caylan, H Ucmak  
...... 346

**Typhoid Myopathy or Typhoid Hepatitis: A Matter of Debate**  
M Mirsadraee, A Shirdel, F Roknee  
...... 351

**Correlation Between *in Vitro* Susceptibility and Treatment Outcome with Azithromycin in Gonorrhoea: A Prospective Study**  
P Khaki, P Bhalla, A Sharma, V Kumar  
...... 354

**Comparison of Radiorespirometric Buddemeyer Assay with ATP Assay and Mouse Foot Pad Test in Detecting Viable *Mycobacterium leprae* from Clinical Samples**  
VP Agrawal, VP Shetty  
...... 358

**Detection of *Mycoplasma* Species in Cell Culture by PCR And RFLP Based Method: Effect of BM-cyclin to Cure Infections**  
V Gopalkrishna, H Verma, NS Kumbhar, RS Tomar, PR Patil  
...... 364
Virulence Factors and Drug Resistance in *Escherichia coli* Isolated from Extraintestinal Infections ......369
*S Sharma, GK Bhat, S Shenoy*

Antimicrobial Susceptibility Testing of *Helicobacter pylori* to Selected Agents by Agar Dilution Method in Shiraz-iran ......374
*J Kohanteb, A Bazargani, M Saberi-Firoozi, A Mobasser*

Outbreak of Acute Viral Hepatitis due to Hepatitis E virus in Hyderabad ......378
*P Sarguna, A Rao, KN Sudha Ramana*

A Comparative Study for the Detection of Mycobacteria by BACTEC MGIT 960, Lowenstein Jensen Media and Direct AFB Smear Examination ......383
*S Rishi, P Sinha, B Malhotra, N Pal*

Cytokine Levels in Patients with Brucellosis and their Relations with the Treatment ......387
*H Akbulut, I Celik, A Akbulut*

Brief Communications

Rapid Detection of Non-enterobacteriaceae Directly from Positive Blood Culture using Fluorescent In Situ Hybridization ......391
*EH Wong, G Subramaniam, P Navaratnam, SD Sekaran*

Latex Particle Agglutination Test as an Adjunct to the Diagnosis of Bacterial Meningitis ......395
*K Surinder, K Bineeta, M Megha*

Helminthic Infestation in Children of Kupwara District: A Prospective Study ......398
*SA Wani, F Ahmad, SA Zargar; BA Fomda, Z Ahmad, P Ahmad*

Clinical and Mycological Profile of Cryptococcosis in a Tertiary Care Hospital ......401
*MR Capoor, D Nair, M Deb, B Gupta, P Aggarwal*

*Candida* spp. other than *Candida albicans*: A Major Cause of Fungaemia in a Tertiary Care Centre ......405
*S Shivaparakasha, K Radhakrishnan, PMS Karim*

Case Reports

*Enterobacter sakazakii* in Infants: Novel Phenomenon in India ......408
*P Ray, A Das, V Gautam, N Jain, A Narang, M Sharma*

Ocular Toxocariasis in a Child: A Case Report from Kashmir, North India ......411
*BA Fomda, Z Ahmad, NN Khan, S Tanveer, SA Wani*

Cutaneous Actinomycosis: A Rare Case ......413
*SC Metgud, H Sumati, P Sheetal*

Fatal Haemophagocytic Syndrome and Hepatitis Associated with Visceral Leishmaniasis ......416
*P Mathur, JC Samantaray, P Samanta*

A Rare Case of Mucormycosis of Median Sternotomy Wound Caused by *Rhizopus arrhizus* ......419
*R Chawla, S Sehgal, S Ravindra Kumar, B Mishra*

*Mycobacterium fortuitum* Keratitis ......422
*C Sanghvi*

Correspondence

*N Nagdeo, VR Thombre*
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combining Vital Staining with Fast Plaque: TB Assay</td>
<td>426</td>
</tr>
<tr>
<td>D Rawat, MR Capoor, A Hasan, D Nair, M Deb, P Aggarwal</td>
<td></td>
</tr>
<tr>
<td>Disseminated Histoplasmosis</td>
<td>427</td>
</tr>
<tr>
<td>PK Maiti, MS Mathews</td>
<td></td>
</tr>
<tr>
<td>Authors’ Reply</td>
<td>428</td>
</tr>
<tr>
<td>RS Bharadwaj</td>
<td></td>
</tr>
<tr>
<td>Microwave Disinfection of Gauze Contaminated with Bacteria and Fungi</td>
<td>428</td>
</tr>
<tr>
<td>VH Cardoso, DL Gonçalves, E Angioletto, F Dal-Pizzol, EL Streck</td>
<td></td>
</tr>
<tr>
<td>Endoscope Reprocessing: Stand up and Take Notice!</td>
<td>429</td>
</tr>
<tr>
<td>A Das, P Ray, M Sharma</td>
<td></td>
</tr>
<tr>
<td>Prevalence of <em>Toxoplasma gondii</em> Infection amongst Pregnant Women in Assam, India</td>
<td>431</td>
</tr>
<tr>
<td>BJ Borkakoty, AK Borthakur, M Gohain</td>
<td></td>
</tr>
<tr>
<td>MR Capoor, D Rawat, D Nair, M Deb, P Aggarwal</td>
<td></td>
</tr>
<tr>
<td>Resurgence of Diphtheria in the Vaccination Era</td>
<td>434</td>
</tr>
<tr>
<td>N Khan, J Shastri, U Aigal, B Doctor</td>
<td></td>
</tr>
<tr>
<td>A Report of <em>Pseudomonas aeruginosa</em> Antibiotic Resistance from a Multicenter Study in Iran</td>
<td>435</td>
</tr>
<tr>
<td>MA Boroumand, P Esfahanifard, S Saadat, M Sheihkvatan, S Hekmatyazdi, M Saremi, L Nazemi</td>
<td></td>
</tr>
<tr>
<td>Trends of Antibiotic Resistance in <em>Salmonella enterica</em> Serovar Typhi Isolated from Hospitalized Patients from 1997 to 2004 in Lagos, Nigeria</td>
<td>436</td>
</tr>
<tr>
<td>KO Akinyemi, AO Coker</td>
<td></td>
</tr>
<tr>
<td>Book Review</td>
<td>438</td>
</tr>
<tr>
<td>Hospital-Acquired Infections: Power Strategies for Clinical Practice</td>
<td></td>
</tr>
<tr>
<td>Reba Kanungo</td>
<td></td>
</tr>
<tr>
<td>Title Index, 2007</td>
<td>440</td>
</tr>
<tr>
<td>Author Index, 2007</td>
<td>442</td>
</tr>
<tr>
<td>Scientific Reviewers, 2007</td>
<td>446</td>
</tr>
</tbody>
</table>
EXTENDED-SPECTRUM BETA-LACTAMASES IN CEFTAZIDIME-RESISTANT ESCHERICHIA COLI AND KLEBSIELLA PNEUMONIAE ISOLATES IN TURKISH HOSPITALS

*S Hoşoğlu, S Gündeş, F Kolaylı, A Karadenizli, K Demirdağ, M Günaydın, M Altindis, R Çaylan, H Ucmak

Abstract

Purpose: To study the prevalence of TEM-, SHV- and GES-type β-lactamases among Escherichia coli and Klebsiella pneumoniae strains having ceftazidime MICs higher than 2 mg/L. Methods: A total of 63 E. coli and 41 K. pneumoniae isolated from five different university hospitals were studied for the existence of TEM-, SHV- and GES-type β-lactamases. Susceptibility tests were carried out according to the criteria of National Committee for Clinical Laboratory Standards. MICs were obtained by agar dilution method. Existence of extended-spectrum β-lactamases (ESBLs) were assessed by double-disc synergy test (DDST). Existence of the above-mentioned β-lactamase genes were studied both by PCR with specific oligonucleotide primers and isoelectric focusing methods. Results: None of the isolates were carbapenem-resistant. DDSTs were positive in 50 (79.3%) and 33 (80.5%) of E. coli and K. pneumoniae, respectively. TEM gene was detected in 41 (65.1%) and 19 (46.3%), whereas SHV gene in 18 (28.6%) and 20 (48.8%) of E. coli and K. pneumoniae strains, respectively. GES genes were not detected. Conclusions: TEM and SHV genes are highly prevalent among ESBL-producing E. coli and K. pneumoniae, whereas GES-type ESBLs are absent and found not to be responsible of ceftazidime resistance in Turkish hospitals.

Key words: Ceftazidime-resistant, E. coli, ESBL, Klebsiella, SHV, TEM, GES

Extended-spectrum β-lactamases (ESBLs) are frequently encountered among clinical Enterobacteriaceae, predominantly Klebsiella pneumoniae and to a lesser extent, Escherichia coli and other species. The genes coding for ESBLs are usually carried by plasmids, which strongly facilitate their spread among strains of many species of Gram-negative bacteria. ESBLs exhibit high degrees of diversity in their structures and activities and several families reflecting their evolutionary and/or functional similarities can be distinguished. The majority of the ESBLs arise by mutations that alter the hydrolytic activities of classical enzymes TEM-1, TEM-2 and SHV-1. The TEM and SHV ESBLs exhibit a considerable variety, mostly with respect to their ranges of substrate preferences and to their levels of hydrolytic activity.

In early 1990s, ESBL-producing gram-negative bacteria, exhibiting a higher level of resistance to cefotaxime than to ceftazidime, were described in Germany (1990), France and Argentina (1992). These were the first reports of gram-negative isolates producing various non-TEM, non-SHV ESBLs, namely CTX-M and GES/IBC types. Such Ambler class A β-lactamases have <40% identity with the β-lactamases of the TEM and SHV series. In the two recently published articles, Wachino et al. designated a novel ceftazidime-hydrolysing class A ESBL (GES-a) as GES-3 and a new cephemycin-hydrolysing and inhibitor-resistant class A ESBL (GES-b) as GES-4. Actually, their articles have described different nomenclature of GES-type ESBLs and controversial conclusions on the relationship between β-lactamase inhibitor resistance and an amino acid substitution in the centre of the omega-loop region. Before Wachino et al. submitted their sequences for GES-3 and GES-4 genes to the GenBank nucleotide database, sequences for GES-3 and GES-4 genes had already been released by Vourli et al. As known, GES-a and GES-b genes are completely different from GES-3 and GES-4 genes. GES-3 and GES-4 were capable of hydrolysing imipenem, whereas GES-a could not hydrolyse imipenem and GES-b had a substrate profile extended to cephemycins as well as imipenem. Presently, the different GES-type ESBLs have been designated by identical names. It is suggested that GES-a and GES-b genes be renamed as GES-5 and GES-6 genes, respectively.

There are hospitals in which GES-type β-lactamases are the most prevalent, but it seems that in the majority of countries, the isolation of GES-producing strains or outbreaks caused by these organisms remain sporadic. There are a number of reports from Turkey about these enzymes. The β-lactamase types confirmed in Turkey were mostly TEM- and SHV-derived ESBLs. In this study, we evaluated TEM, SHV and GES types of ESBLs among phenotypically ceftazidime-resistant K. pneumoniae and E. coli strains from five different Turkish university hospitals.

*Corresponding author (email: <hosoglu@hotmail.com>)

Department of Infectious Diseases and Clinical Microbiology, Dicle University Hospital (SH, HU), Diyarbakir; Kocaeli University Hospital (SG, FK, AK), Kocaeli; Fatih University Hospital (KD), Elazig; Ondokuzmayis University Hospital (MG), Samsu; Kocatepe University Hospital (MA), Afyon; Karadeniz Technical University Hospital (RC), Trabzon, Turkey

Received: 18-01-07
Accepted: 30-05-07
Materials and Methods

Study design

Sixty-one *E. coli* isolates and 43 *K. pneumoniae* isolate resistant to ceftazidime were collected from five university hospitals located in different cities throughout Turkey (Dicle University Hospital in Diyarbakir, Ondokuzmayis University Hospital in Samsun, Kocatepe University Hospital in Afyon, Firat University Hospital in Elazig and Farabi Hospital in Trabzon). The clinical microbiology laboratories of the hospitals performed identification of the species of the isolated strains and preliminary determinations of their susceptibility patterns. All bacteria were transferred to Infectious Diseases Research Laboratory at Kocaeli University Hospital, Kocaeli, Turkey.

Microbiological methods

The bacterial isolates potentially harbouring ESBLs were those with a positive phenotypic confirmatory test for ESBLs according to current National Committee for Clinical Laboratory Standards (NCCLS) criteria.14

Antibiotic susceptibility testing

All strains were re-identified before the study. The strains were inoculated into MacConkey’s agar and initially identified by glucose and lactose fermentation and oxidation, citrate utilization, urea hydrolysis, indole and oxidase production by glucose and lactose fermentation and oxidation, citrate (DDST). DDST was done to determine synergy between a disc agar plates were prepared and inoculated with standardized inoculum (0.5 McFarland tube) to form a pure culture. Disc (30 µg) of each 3GC antibiotics was placed on the agar at a distance of 15 mm centre to centre from amoxicillin/clavulanic acid disc. ESBL production was interpreted if the inhibition zone around the test antibiotic disc increased towards the amoxicillin/clavulanic acid disc or if neither discs were inhibitory alone but bacterial growth was inhibited where the two antibiotics diffuse together.

Isoelectric focusing of β-lactamases

β-lactamases were released by freezing and thawing a dense suspension of bacteria in 0.1 m phosphate buffer (pH 7.0) 10 times. After centrifugation for 15 min at 12,000 × g, supernatants were subjected to an amnophilic gel with a pH range of 3.5-10. Ampholine gels were prepared according to the formulation of Matthew et al.16 but were supplemented with 10% sucrose. After focusing at 10 W for 90-120 min at 4 °C on an isothermal-control electrophoresis apparatus (model CWS-2000; ISOLAB, Inc, Akron, Ohio), the enzymes were located with 1 mm nitrocefin in 0.1 m phosphate buffer (pH 7.0). Estimations of pl values were made by comparison with standards TEM-1 (5.4), TEM-2 (5.6), TEM-3 (6.3) and SHV-1 (7.6).

Screening for ESBL gene(s) was performed by PCR using the primers for *bla* TEM, *bla* SHV, and *bla* GES. On the isoelectric focusing gel, β-lactamase activities with pl of 5.4, 5.6 and 7.6 were detected in most isolates. On the basis of DNA sequencing and pl values, the β-lactamase activity of pl 5.4 corresponds to that of TEM-1 β-lactamase, the pl value of 6.3 represents TEM-3 β-lactamase and the β-lactamase activity of pl 7.6 corresponds to that of SHV-1 β-lactamase.

Genes of the *bla* TEM, *bla* SHV and *bla* GES types identified by PCR assays, using as a template of total bacterial DNA and specific primers are given in Table 1. PCR screenings were accomplished in a final volume of 50 µL with a 5-µL DNA extract. The master mixture was composed of 1X buffer (supplied with DNA polymerase; Fermentas, Lithuania), 1.5 mM MgCl2, 0.8 mM dNTPs, 50 pmol primers each and 1.5 U DNA polymerase. Amplification was accomplished after a 5 min denaturation at 95 °C by 40 cycles of 1 minute at 55 °C, 1.5 minute at 72 °C and 1 minute at 94 °C. PCR products were run on a 1.5% agarose gel at constant 12 V/cm and visualized on a UV lamp. PCR assays for *bla* ESBL genes coding for enzymes containing the 278U19 and 733L20 substitutions were performed as described by Palucha et al.17

<table>
<thead>
<tr>
<th>Forward</th>
<th>Reverse</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHV-type</td>
<td>5′-CggTCAGCGAAAAACACCT-3′</td>
<td>5′-TCCCGcAGATAAATCACCAC-3′</td>
</tr>
<tr>
<td>TEM-type</td>
<td>5′-ATgAgATATCCACACATTTCCgTg-3′</td>
<td>5′-TTACCAATgCTTAATCGTcAg-3′</td>
</tr>
<tr>
<td>GES-type</td>
<td>5′-gCgTTTTtCAATgTgCCTCAAC-3′</td>
<td>5′-CGCGCCCATAgAGCATTAg-3′</td>
</tr>
</tbody>
</table>

www.ijmm.org
Results

A total of 63 *E. coli* and 41 *K. pneumoniae* isolated from five different university hospitals were studied for the existence of TEM-, SHV- and GES-type β-lactamases. None of the isolates were found carbapenem-resistant. DDSTs were positive in 50 (79.3%) and 33 (80.5%) of *E. coli* and *K. pneumoniae*, respectively (Table 2).

Overall, 75 (72.1%) isolates, (47 *E. coli* and 28 *K. pneumoniae*) were characterized as ESBL producers. TEM gene was detected in 41 (65.1%) and 19 (46.3%), whereas SHV gene in 18 (28.6%) and 20 (48.8%) of *E. coli* and *K. pneumoniae* strains, respectively. In total, 47 *E. coli* isolates (74.6%) and 28 *K. pneumoniae* (68.3%) were detected as ESBL producer. GES genes were not detected (Table 2).

The distribution of ESBL producer strains was shown in Table 3. There were no significant differences between the hospitals in species distribution (chi-square = 1.8, \(P > 0.05\)) and rates of ESBL producers within each species (chi-square = 0.08, \(P > 0.05\)). There was no significant difference between the *E. coli* and Klebsiella strains for producing ESBL. The most active antibiotic was meropenem (none of the isolates was resistant to this drug) followed by piperacillin-tazobactam, considering all isolates or ESBL producers only (Table 4).

<table>
<thead>
<tr>
<th>Table 2: ESBLs detected by clavulanate synergy test and PCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacteria</td>
</tr>
<tr>
<td>----------------------------</td>
</tr>
<tr>
<td><em>E. coli</em> (strains)</td>
</tr>
<tr>
<td>ESBL positive</td>
</tr>
<tr>
<td>ESBL negative</td>
</tr>
<tr>
<td><em>K. pneumoniae</em></td>
</tr>
<tr>
<td>ESBL positive</td>
</tr>
<tr>
<td>ESBL negative</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
<tr>
<td><strong>ESBL positive</strong></td>
</tr>
<tr>
<td><strong>ESBL negative</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3: The distribution of ESBL producer strains according to centres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
</tr>
<tr>
<td>Hospitals’ total positive strains (%)</td>
</tr>
<tr>
<td><em>E. coli</em> (63 strains)</td>
</tr>
<tr>
<td>ESBL positive (47)</td>
</tr>
<tr>
<td>ESBL negative (16)</td>
</tr>
<tr>
<td><em>K. pneumoniae</em> (41 strains)</td>
</tr>
<tr>
<td>ESBL positive (28)</td>
</tr>
<tr>
<td>ESBL negative (13)</td>
</tr>
</tbody>
</table>

DUH - Dicle University Hospital, OMUH - Ondokuzmayis University Hospital, AKUH - Afyon Kocatepe University Hospital, FUH - Firat University Hospital, Farabi H - Farabi Hospital

<table>
<thead>
<tr>
<th>Table 4: Antimicrobial resistant patterns (MIC as µg/L) of ESBL positive and ESBL negative strains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolates</td>
</tr>
<tr>
<td><em>E. coli</em> (63 strains)</td>
</tr>
<tr>
<td>ESBL positive (47)</td>
</tr>
<tr>
<td>ESBL negative (16)</td>
</tr>
<tr>
<td><em>K. pneumoniae</em> (41 strains)</td>
</tr>
<tr>
<td>ESBL positive (28)</td>
</tr>
<tr>
<td>ESBL negative (13)</td>
</tr>
</tbody>
</table>

Discussion

ESBL antibiotics are commonly included in the empirical antibiotic regimens for treatment of nosocomial infections. Especially, the selection of ESBL-producing de-repressible microorganisms in infection site is increasing by the clinical usage of broad-spectrum cephalosporins. Since then, several outbreaks have been reported in many European countries and the USA, the epidemiology of ESBLs has showed that this type of resistance problem is endemic in several places worldwide, with rates exceeding 50% in some countries. The prevalence of ESBL-producing Klebsiella and E. coli was found high in different studies in Turkey. In a three-year study, the rates of production of ESBLs were found to be 20.9% for E. coli and 50% for K. pneumoniae, using ceftazidime and ceftazidime/clavulanic acid E-test strips, at a Turkish university hospital. In this study, ESBL production increased each year (21.7%, 22.1% and 45.5%).

Currently, there are many different methods for detection of ESBLs in laboratory settings but controversies exist regarding the clinical importance of such resistance, the choice of optimal laboratory methods to detect it. ESBL-mediated resistance could be determined by the combined disk methods, the DDST, the three-dimensional agar test, rapid automated systems using commercial cards, E-test ESBL strip and PCR detection methods. Some studies suggest that clinical microbiology laboratories should not rely on the rapid automated systems for method for screening ESBL producers but use another more reliable system such as the E-test. In our study, we used DDST and results were confirmed by PCR with specific oligonucleotide primers and further confirmed by isoelectric focusing of β-lactamase enzymes from the bacterial extracts.

The varieties of ESBLs are very rich in Turkey. Different types of SHV and TEM are endemic in Turkey. GES, CTX-M and PER types also were reported from Turkey in recent years. In our study since we did not detect GES types among E. coli and Klebsiella strains, we believe that this type of β-lactamases is not endemic or very rare in Turkey.

Acknowledgement

This study was supported by a short-time fellowship from UNESCO-MSBC.

References


**Source of Support:** short-time fellowship from UNESCO-MSBC.

**Conflict of Interest:** None declared.