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A Study on Prevalence of Extended-Spectrum Betalactamase Producing E.coli among Various Clinical Samples at a Tertiary Care Hospital, South India

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Abstract

In later years the rate of expanded spectrum beta lactamase-producing microbes has gotten progressively high causing difficulty in the treatment choices. The current study attempted to identify the predominance of extended-spectrum beta-lactamases among Escherichia coli confines from different clinical samples. A prospective investigation was conducted over a duration of 6 months. Throughout the December 2023–May 2024 study period, about 70 non-repetitive clinical segregates of Escherichia coli from various clinical samples (urine, blood, pus, & other body fluids) were taken into consideration. Their Antimicrobial susceptibility patterns were noted and later inoculated on ESBL base agar. MIC detection was done by an E-test. The double disc synergy test, which uses combination discs containing clavulanic acid and cephalosporin, was used to validate the ESBL phenotypic detection. Of the 70 confines, 36(51.4%) were extended-spectrum beta-lactamase makers and 8(22.2%) segregates among them were multidrug-resistant Escherichia coli. Urine samples accounted for 41.4% the majority followed by exudates and blood. Majority of the isolates were sensitive to Meropenem followed by piperacillin tazobactam and Imepenem. According to the study's findings, there is a high prevalence of ESBL generation, which calls for the use of appropriate antimicrobial treatments and contamination control procedures.

Keywords

Drug resistance, E.coli, Extended-spectrum betalactamases, gram negative bacteria.

INTRODUCTION

Antimicrobial resistance (AMR) poses a serious threat to public health because it has the potential to reduce the effectiveness of antimicrobial medications that are currently available for treating bacterial diseases, antimicrobial resistance (AMR) poses a serious threat to public health. Escherichia coli has historically been the most commonly confined species within the Enterobacteriaceae family. Among the major risk factors for multidrug-resistant E. Coli infection are prolonged hospital stays, prolonged antibiotic exposure, severe illness, and unusual use of third-generation cephalosporins [1]. The principal mechanism of resistance to cephalosporins and penicillins is the production of β-lactamase. ESBLs (Extended Spectrum B-Lactamases) are enzymes that show expanded hydrolysis of the side chains of oxyimino-β-lactams, such as aztreonam, ceftriaxone, cefotaxime, and ceftazidime. Reports about them have increased over the past few years. These enzymes have been detailed from distinctive locales and are identified in different E. coli strains essentially [2]. This ESBL generation has moreover been found in other members of Enterobacteriaceae and other gram-negative microbes [3] [4]. ESBL-creating strains are likely more predominant than is right now recognized. Therefore, up-to-date knowledge of the prevalence of ESBL generation by one of the frequently isolated life forms, like E. coli, is crucial for comprehending the illness burden and implementing crucial precautions to stop the spread [5]. The current "study aimed to determine the prevalence of ESBL-producing E. coli and its profile of antimicrobial resistance in order to develop a strong antimicrobial strategy and an appropriate hospital infection control procedure to anticipate the spread of these drug-resistant strains".

MATERIALS & METHODS

A six-month prospective study was carried out between December 2023 and May 2024. There were about seventy non-repeating clinical strains of Escherichia coli from different clinical samples (blood, pus, urine, and other bodily fluids) [6]. Gram stain, standard biochemical reactions, and colony morphology were used to identify the clinical strains. Following the determination of the antibiotic susceptibility pattern, ESBL base agar was inoculated. E-test was used to detect MIC. The double disc synergy test, which uses combination discs containing clavulanic acid and cephalosporin, was used to validate the ESBL phenotypic detection.

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Antimicrobial Susceptibility Testing:

The sensitivity pattern of the organism was evaluated "using the Kirby Bauer disc diffusion approach and Muller Hinton Agar. Amikacin (AK), gentamicin (GEN), cefuroxime (CXM), cefixime (CFM), cefotaxime (CTX), ceftazidime, Ciprofloxacin (CIP), meropenem (MEM), imipenem (Imp), piperacillin-tazobactam (PTZ), colistin (CL), nitrofurantoin (NIT), and cefepime (CPM) were among the various anti-microbials of Himedia that were utilized. The findings were explained as per the CLSI (Clinical & Laboratory Standards Institute) recommendations. Multidrug-resistant isolates were those that remained resistant to 3 or more classes of antibiotics".

Double Disc Synergy Test

The combination disk approach provided phenotypic confirmation of the ESBL production. The antimicrobial plates that were used contained combinations of cephalosporins (Ceftazidime/Cefotaxime) and cephalosporins and clavulanic acid (Ceftazidime/Cefotaxime Clavulanic acid). When compared to the restraint zone of the antimicrobial tested alone, a ≲5mm rise in the growth inhibition zone for any antimicrobial linked with clavulanic acid indicated the generation of ESBL. When comparing the ceftazidime or cefotaxime disc to the disc constituting clavulanic acid alone, the isolate was found out to be positive for ESBL generation if the zone diameter of inhibition surrounding the discs containing clavulanic acid and cefotaxime was larger than 5mm.

RESULTS

Urine samples accounted for 41.4%, or the majority, of the 70 isolates. Other samples, such as exudates (4.3%, 3/70), blood (25.7%, 18/70), pus/wound pus samples (28.5%, 20/70), and other samples were also used to isolate E. coli. [7]

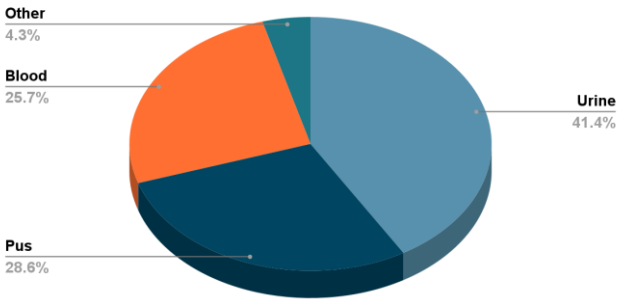

Figure 1. Percentage of E. coli found in different clinical sample isolates.

90% of patients showed maximum sensitivity to Meropenem, followed by 88% of patients to Piperacillin tazobactam, and 85% of patients to Imipenem [8] [9] [10]. Moderate activity was seen with Nitrofurantoin (58%) and Colistin (53%) [11].

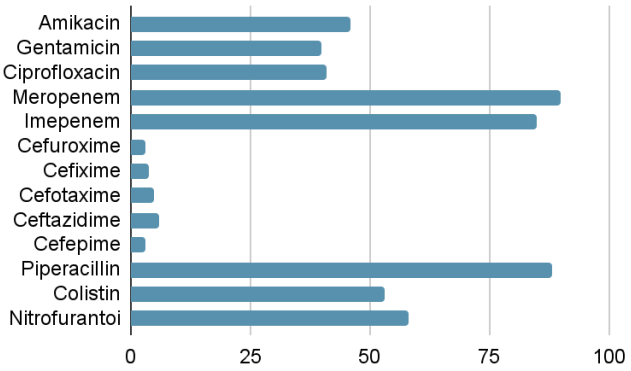

Figure 2. Escherichia coli's pattern of antibiotic susceptibility

Of the 70 isolates, 36 (51.4%) produced extended-spectrum beta-lactamases, and 8 (22.2%) of them were Escherichia coli isolates resistant to multiple drugs.

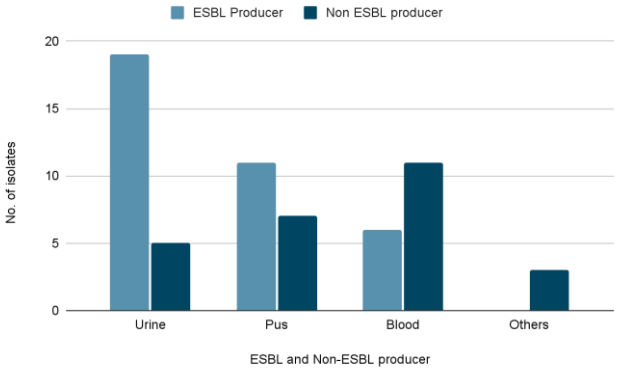

Figure 3. Distribution of ESBL producing isolates among various clinical isolates

DISCUSSION

Because ESBL-producing strains are resistant to aztreonam, trimethoprim/sulfamethoxazole, quinolones, and all penicillins as well as cephalosporins (which include third and fourth generation medications), they pose a particular threat [12] [13]. Effective disease control strategies and appropriate treatment depend on early detection of ESBL production. The increasing diversity of drug-resistant bacterial segregates that are resistant to ESBL can pose significant challenges for clinicians when selecting viable restorative options. Furthermore, the presence of ESBL-producing microbes increases treatment costs, lengthens hospital stays, and increases mortality. Consequently, controlling illness within clinics may lower the frequency of ESBL-producing bacteria as well as their dissemination to neighboring communities [14] [15]. The incidence of resistance seems to be decreased by the sparing use of antibiotics. The majority of the segregates in our investigation were susceptibly vulnerable to piperacillin tazobactam, imipenem, & meropenem [8] [10] [16].

CONCLUSION

The present study concludes that there is a high prevalence of ESBL generation. Because these germs limit the options available for restorative care, appropriate antimicrobial treatment & the implementation of suitable disease control approaches are necessary to prevent the dissemination of these pathogens [17]. The territorial information obtained from this consideration will offer assistance in directing suitable anti-microbial utilization which is profoundly fundamental.

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