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ANTIMICROBIAL RESISTANCE IN *E. COLI* AT BENUE STATE UNIVERSITY TEACHING HOSPITAL (BSUTH), MAKURDI, NIGERIA

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ABSTRACT

The study reports three cases of extreme high rates of antimicrobial resistance of *Escherichia coli* isolates by the Microbiology laboratory within three weeks. This is based on findings from antimicrobial susceptibility reports on *Escherichia coli* of patients during routine laboratory procedures on submitted clinical samples in the first three weeks of March, 2014. Specimens were collected, transported, stored and processed using standard laboratory procedures, and susceptibility tests were carried out using modified Kirby-Bauer's method. Among the 11 antibiotics that are routinely tested for activity against *E.coli*, all the three isolates were resistant to amoxicillin, amoxicillin-clavulanic acid (augmentin), perfloxacin, cotrimoxazole. gentamicin, ciprofloxacin, ofloxacin, ceftriaxone, chloramphenicol, and cefuroxime but all were susceptible to Streptomycin. Empirical treatment of *E. coli* infections with third generation cephalosporins and quinolones should be carried out in line with the local sensitivity patterns of such drugs in order to avoid therapeutic failure with them.

INTRODUCTION

Antimicrobial resistance is increasingly becoming a major challenge in the management of both human and animal diseases world over [1,2]. The challenge associated with the management of life threatening infections such as tuberculosis, typhoid fever, Human Immunodeficiency virus and malaria among others are all traceable to high rates of treatment failure accessioned by equally high resistance [3-5]. Globally, antimicrobial resistance is believed to account for at least 150 million human deaths yearly with over 950 million prolonged illnesses with associated consequences [6-9].

This trend may be more worrisome in resource constrained settings where facilities are in adequate supply for proper susceptibility testing. In addition, with lack of experienced personnel for sensitivity testing, and paucity of records for intended tests, actual tests, and treatment failures, the actual impact may be much higher than documented [10,11].

Findings from Maiduguri showed the resistance pattern of *E. coli* to gentamicin, streptomycin, chloramphenicol, and sulphamethoxazole-trimethoprim to be 8.3%, 8.3%, 25.0% and 25.0% respectively [12]. In Ibadan on the other hand, *E. coli* was found to be 100% resistant to amoxicillin, clavulanate, co-trimoxazole and ampicillin with resistance to ofloxacin, gentamicin, nalidixic acid tetracycline in the rage of 70%, 92%, 96%, and 88% respectively [13].

The upsurge of *Escherichia coli* resistance over the past decade has equally thrown up another big challenge in the management of its infections in the hospital settings given its preponderance as the commonest

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Enterobacteriaceae recovered from clinical specimens [14,15]. In Spain a nationwide survey in 2006 showed *E.coli* Extended –spectrum –beta-Lactamases (ESBL) acquisition of up to 52% [16], while in Australia 82% of *E. coli* ST131 strains expressed resistance when tested in vivo via mutagenesis of phospholipids [17]; and in India diarrhoeagenic *E.coli* (DEC) was responsible for a large number of paediatric deaths due to high resistance from gene acquisition[18].

In USA and China among liver transplant patients, it was found that *E.coli* was among the commonest Gram negative bacilli with the highest multiple-drug resiatance including the aminoglycosides, quinolones and cephalosporins [19,20]. Similarly, Carbapenemases producing *E.coli* were recovered from ICUs in Greece, Spain and other European countries which had already shown resistance to higher quinolones and cephalosporins [21]. In Brazil and Argentina, similar high multiple resistance patterns of *E.coli* against newer generation penicillins and carbapenems were equally documented [22].

The outcome of antimicrobial susceptibility reports on *E.coli* at BSUTH within a span of three weeks prompted this study to document and discuss their spot findings.

MATERIALS AND METHODS

The study carried out at BSUTH was based on observations of antimicrobial susceptibility reports of *E. coli* within a span of three weeks (3^{rd} to 24^{th}) in March 2014 [23]. Specimens were collected, transported and processed using standard laboratory procedures. Susceptibility tests were carried out using modified Kirby-Bauer's disk diffusion methods. Culture broths' turbidity were gauged with 0.5 Mc-Farland's standard and antibiotic disks of 6mm diameters were used. The antibiotic concentrations of the discs were as follow: Amoxicillin (10µg), Amoxicillin-Clavulanic acid (20µg), Perfloxacin (µg), Cotrimoxazole (µg). Gentamicin (10µg), Ciprofloxacin (5µg), Ofloxacin (5µg), Ceftriaxone (30µg), Chloramphenicol (30µg), Cefuroxime (30µg) and Streptomycin (10µg). Culture plates were incubated overnight at 36.5^0C [24]. Two of the isolates were from urine while the third was from a post operative wound swab.

RESULTS

The three persons from whom the *E.coli* isolates were recovered were all in patients, each had been on admission for at least five days. Two of the subjects were from urine samples while a third was from a post-operative site. All the subjects between the ages 25 to 55 years, two males and a female from whom *Ecoli* was recovered from urine sample.

Three isolates of *E.coli* tested against 10 antibiotics during the period had the following antimicrobial susceptibility patterns. All the three isolates were resistant to the following antibiotics with corresponding concentrations in disks of 6mm diameters each: Amoxicillin (10µg), Amoxicillin-Clavulanic acid (20µg), Perfloxacin (µg), Cotrimoxazole (µg). Gentamicin (10µg), Ciprofloxacin (5µg), Ofloxacin (5µg), Ceftriaxone (30µg), Chloramphenicol (30µg), and Cefuroxime (30µg) but all were susceptible to Streptomycin(10µg). (Table 1).

Table 1. Antimicrobial susceptibility patterns of three *E. coli* isolates at Benue state University Teaching Hospital, March 2014.

Antimicrobial	Susceptibility Report
Amoxicillin (10µg)	Resistant
Amoxicillin- Clavulanic acid (Augmentin) (20µg)	Resistant
Perfloxacin (5µg)	Resistant
Cotrimoxazole (23.75µg)	Resistant
Gentamicin (10µg)	Resistant
Ciprofloxacin (5µg)	Resistant
Ofloxacin (Tarivid) (5µg)	Resistant
Ceftriaxone (Rocephin) (30µg)	Resistant
Chloramphenicol (30µg)	Resistant
Cefuroxime (Zinacef) (30µg)	Resistant
Streptomycin (10µg)	Susceptible

NB: Concentration of antibiotics in Discs of 6 millimetres given in parenthesis.

DISCUSSION

Among the three isolates of *E.coli*, only one was from an immunocompromised subject, the other two were not while none of them was diabetic. All the three *E. coli* isolates were resistant to all the antimicrobials tested except streptomycin to which all were susceptible. This pattern of resistance cuts across third generation cephalosporins and quinolones, the group of drugs often reserved for empirical antimicrobial treatments in resource-constrained settings [25]. Along with potentiated penicillins, they are often given as prophylactics in intra- or immediate post-operative periods [26]. This brings to fore that with the acclaimed potency of some of these

antimicrobials some strains of *E.coli* may nevertheless be resistant to almost all commonly used antibiotics and clinicians need to be aware in the course of decisions on antimicrobial choices [27]. This pattern of resistance has severally been documented: in India *E.coli* was found to be 100%, 90.8%, 80.5%, 95.8% 73.3% and 72.5% resistant to nalidixic acid, ampicillin, doxycycline, co-trimoxazole, ofloxacin and ciprofloxacin respectively similar to the group of drugs tested in the present study[28]; in The Netherlands, resistance to beta- lactams and quinolones was found to increase dramatically from 6.6% to over 55.7% over a short period [29]; in South Korea, where multidrug-resistant (MDR) *E. coli* involving several beta-lactams and quinolones was documented although with reduced (16.8%) quinolone resistance[30]; and Ethiopia where all the *E. coli* isolates were ≥80.0% resistant to erythromycin, amoxicillin and tetracycline with MDR involving quinolones and third generation cephalosporins [31]. Although findings from Germany [32], Egypt [33], and Brazil [34] showed generally higher susceptibility profiles of *E. coli* isolates, the incidence of MDR involving 2-6 antimicrobials was still not uncommon. The variations in the sources of the isolates- community-acquired versus nosocomial, level of antibiotic pressures in the local communities, local policies on antibiotics intake, and inherent rates of mutations of the associated *E.coli* strains could account for this difference. While still emphasizing carrying out sensitivity tests on even the assumed highly potent antibiotics to avoid therapeutic failure, local periodic antibiograms on them should be carried and made available as a guide in cases of emergency. A surveillance method should be put in place in the hospital to periodically evaluate the emergence of resistant pathogens [35]. Also visitors and patients' relations should be adequately controlled in the hospital environment so as to prevent their colonization with these potential super bugs and eventual distribution in the larger community. The highly resistant *E.coli* strains recovered from these patients is most likely to have been acquired from the hospital environment (Nosocomial) in the course of their admission and antibiotic pressure coupled with the process of natural selection could have played a significant role in the emergence of this resistance pattern. This is not the first time the authors noticed these findings, however the frequency and scope of resistance has been on a steady increase and is gradually involving other bacterial species.

The relatively high susceptibility of the *E. coli* isolates to streptomycin could be attributed to the relatively lower rate of its abuse in the management of non-specific bacteria infections since it is generally reserved for treatment of tuberculosis[36].

CONCLUSION

This study has shown that *E. coli* could be resistant to all the antibiotics within a hospital setting, hence antimicrobials generally believed to be active should as well be subjected to periodic sensitivity testing, and such reports consulted during empirical treatment.

In both surgical and medical emergencies as well as for prophylaxis where *E. coli* may stand the chance of being among the commonest implicating bacteria, empirical antimicrobial prescriptions should depend on the most recent susceptibility pattern of isolates in the locality.

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CONFLICT OF INTEREST:

The authors declare that they have no conflict of interest.

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