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NEONATAL INFECTIONS CAUSED BY *ESCHERICHIA COLI* AT THE NATIONAL HOSPITAL, ABUJA: A THREE-YEAR RETROSPECTIVE STUDY.

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ABSTRACT

Background: *Escherichia coli* (*E.coli*) has been implicated as a common cause of both early and late onset neonatal infections. The emergence of different strains of E.coli that are multiply resistant to commonly used antibiotics has made continuous antibiotics surveillance relevant. Knowledge about common infections caused by E.coli as well as its antibiotics susceptibility pattern will guide paediatricians in choosing appropriate antibiotics for empirical treatment of neonatal infections.

Methods: A retrospective study of *E.coli* neonatal infections in NHA was conduct for the period 1st January 2010 to 31st December 2012. The records of all specimens submitted to the Medical Microbiology laboratory within the neonatal period (first 28 days of life) were examined and data about *E.coli* isolates and their antibiotics susceptibility pattern were retrieved and evaluated.

Results: 251(33.2%) bacteria were isolated out of a total of 757 specimen submitted for analysis within the period under review. 17(6.8%) were E.coli; 16 were from soft tissue specimen and one from blood. There was no isolate of *E.coli* from CSF. Most of the isolates were resistant to commonly used antibiotics for treatment of neonatal infections. Three isolates were resistance to amoxicillin-clavulanate and ceftriaxone. One isolate was resistance to amoxicillin-clavulanate, ceftriaxone and imipenem. 100% and 80% of the strains tested were susceptible to amikacin and imipenem respectively.

Conclusion: *E.coli* is third among the gram negative bacteria isolated within the period under review. Most of them were resistant to commonly used antibiotics for treating neonatal infections but, susceptible to amikacin and imipenem. There is need for regular antibiotics resistance surveillance and stewardship.

Keywords: Neonates, *E.coli* Infections, Antibiotics Resistance, Abuja.

INTRODUCTION

Infections have been identified as the most common cause of death in the neonatal period in both developed and developing countries (1,2). These infections include neonatal sepsis, meningitis, pneumonia, and soft tissue infections. *Escherichia coli* (E.coli) has been implicated as one of the most common isolates recovered from specimen submitted for processing due to infection in this age group(1).It has been implicated as a common cause of neonatal sepsis(1,3), neonatal meningitis(3), neonatal bacteremia (4), and neonatal soft tissue infection(4). *E.coli* is able to cause these infections because they are among the first set of bacteria that colonize the newborn. It exists as a normal flora of the gastrointestinal tract of human(5) and can easily spread from the rectum to the female genital tract through the perineum(1,5). Vaginal *E.coli* colonization is detected in 7-13% of pregnant women and 21% in the blood of fetuses that have died during the third trimester of pregnancy (6,7). Neonates acquire *E.coli* intrapatum and during labour (5,6,7).

The immune system of neonate is not fully developed at birth and till date, no preventive measures have been advocated for *E.coli* colonization of the birth canal (1). *E.coli* and group B β-haemolytic streptococcus (GBS) are the commonest bacteria mentioned as a cause of early onset neonatal sepsis (EONS) in developed countries(8). However, following the introduction of late antenatal screening and intrapatum antibiotics prophylaxis in 1996 which led to a reduction in GBS, the gram negative bacteria such as *E.coli* have become prevalent as a cause of EONS(8). Previous studies in our center implicated *E.coli*, *K.pneumoniae, P.aeruginosa* and *S.aureus* as common causes of infections in the neonatal period similar to what has been reported from other centres in Nigeria(9,10).

The occurrence of antibiotics resistance in E.coli continue to increase nationwide both for single and to multi-class resistance to several antibiotics (multi-drug resistance [MDR]) (11,28). The recent trend in antibiotic resistance has seen the emergence of different strains of *E.coli* that elaborate resistance enzymes such as Extended-Spectrum Beta Lactamases (ESBLs) producer, AmpC β-lactamases and carbapenemases that confer multiple resistance to commonly used antibiotics for treatment of infections(11,12,27,28) . These have made continuous antimicrobial surveillance a priority in clinical microbiology laboratories.

The aim of this study was to evaluate the prevalence of *E.coli* as a cause of neonatal infections as well as their antibiotics susceptibility pattern in the last three years in NHA. The outcome of this study will guide the paediatrician in the management of suspected cases of E.coli infections, and direct further research.

METHODS

This is a retrospective study carried out at the National Hospital Abuja, a 200 bedded tertiary healthcare institution, located in the Federal Capital Territory (FCT), Nigeria. It has a well equipped Special Care Baby Unit (SCBU) and Neonatal Intensive Care Unit (NICU). The hospital serves as a tertiary healthcare and referral centre for the inhabitants of Abuja and neighboring states.

The records of the Department of Medical Microbiology and Parasitology laboratory of the hospital from Jan. 1st 2010 to Dec. 31st 2012 were reviewed. All isolates from blood culture, Cerebrospinal fluid (CSF) and soft tissue (wound swab, eye swab, ear swab, umbilical cord, pus) specimens from neonates that were conclusively identified as pathogens were included in the study, while contaminants were excluded. E.coli isolates were specifically reviewed with emphasis on the age, sex, type of specimen submitted to the laboratory for analysis as well as their antibiotics susceptibility pattern.

In our facility during the study period, blood cultures were usually performed with Oxoid signal system (Oxoid, Basingstoke, UK) or BACTEC 9050(Becton-Dickson, New Jersey, USA) continuous-monitoring blood culture systems. CSF analysis, soft tissue culture and bacterial identification were performed using standard microbiology techniques (13). The Modified Kirby-Bauer disc diffusion method was used for antibiotics susceptibility testing and interpreted based on the Clinical and Laboratory Standard Institute (CLSI) recommendations (14).

RESULTS

A total of 757 specimen comprising blood(245), CSF(127) and soft tissue(385) were submitted for processing during the period under review. 251(33.2%) pathogens were isolated, out of which 247 (98.4%) were bacteria isolates while 4(1.6%) were Candida species (Table 1). 17 (6.8%) were identified as *E.coli*; one from blood culture, non from CSF, 16 from soft tissue specimens (Table 2).

S.aureus was the predominant bacteria isolated, accounting for 143 (56.5%) of the 251 isolates and the most frequently isolated pathogen across all the specimens types submitted for processing (Table 2).

TABLE 1: YIELD OF ISOLATES BY SPECIMENS.

Specimen types	Total No of specimen	Isolates		Total
		Bacteria	Candida spp	
Blood culture	**245**	**94**	**2**	**96**
CSF	**127**	**7**	**0**	**7**
Soft tissue	**385**	**146**	**2**	**148**
Total	**757**	**247(98.4%)**	**4(1.6%)**	**251(100%)**

spp: Species., CSF: Cerebrospinal Fluid.

TABLE 2: PATHOGENS ISOLATED FROM DIFFERENT SAMPLES.

Isolates	Blood culture	CSF	Soft tissue	Total	Percentage
E.coli	1	0	16	17	6.8%
S.pyogenes	0	0	8	8	3.2%
S.aureus	62	4	77	143	57.0%
Enterococcus spp	6	1	7	14	5.6%
L.monocytogenes	1	0	0	1	0.4%
Klebsiellae spp	8	1	12	21	8.4%
P.aeruginosa	5	0	14	19	7.6%
CoNS	4	0	0	4	1.6%
Proteus spp	1	0	4	5	2.0%
Serratia marcescens	2	0	1	3	1.2%
Citrobacter freundii	1	0	3	4	1.6%
M. morgagnii	1	0	2	3	1.2%
Alcaligenes spp	2	0	1	3	1.2%
Neisseria spp	0	1	0	1	0.4%
Acinectobacter spp	0	0	1	1	0.4%
Candida spp	2	0	2	4	1.6%
Total	96	7	148	251	100%

CSF: CerebroSpinal Fluid. CoNS: Coagulase Negative Staphylococci, SPP: Specie

All the 17 isolate of E.coli were from neonates older than 72hours; 8 from females and 9 from males. Wound and umbilical swabs specimen were the predominant specimen received (Table 3). 80%, 81.8%, 83.3%, and 62.5% of the tested *E.coli* strains were resistant to ampicillin, amoxicillin-clavulanate, gentamicin and cefuroxime respectively, while 40%, 33.3%, 66.7% and 20% were resistant to cefotaxime, ceftriaxone, ceftazidime and imipenem respectively. All tested *E.coli* strains were sensitive to amikacin (Table 4).

TABLE 3: DISTRIBUTION OF *E.COLI* ISOLATES

Specimen type	No. of Isolates	Percentage
Blood Culture	1	5.9%
Wound swab	5	29.4%
Umbilical swab	5	29.4%
Eye swab	3	17.6%
skin swab	2	11.8%
Scalp swab	1	5.9%
Total	17	100%

TABLE 4: ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF *E.COLI* ISOLATED

Antibiotics	No tested	Susceptible(%)	Resistant(%)
Ciprofloxacin	7	5(71.4)	2(28.6)
Ofloxacin	4	2(50)	2(50)
Cefotaxime	10	6(60)	4(40)
Cefuroxime	8	3(37.5)	5(62.5)
Amox-Clav.	11	2(18.2)	9(81.8)
Genticin	6	1(16.7)	5(83.3)
Amoxicillin	5	1(20.0)	4(80.0)
Ceftazidime	6	2(33.3)	4(66.7)
Imipenem	5	4(80)	1(20%)
Amikacin	7	7(100)	0 (0)
Ceftriaxone	6	4(66.7)	2(33.3)

DISCUSSION

It has been revealed in this study that most of the *E.coli* isolated were from soft tissue specimens; it is difficult to ascertain whether they represent true infections or colonization of the newborn. No conclusion can be made concerning the only isolate from blood except to say that it most probably represent a true infection. S.aureus is the most common bacteria cause of infections in this age group. It is the predominant bacterial isolate from blood culture, followed by *K.pneumoniae*. This finding is in agreement with similar studies from Maiduguri and Uganda on neonatal infections which showed *S.aureus* as the predominant pathogen, followed by *Klebsiellae pneumonia* (15,16). It however, contrast with a previous study done in this center between 2002 to 2004 which showed almost equal representation of both gram negative and gram positive bacteria as causes of neonatal sepsis(9) and a prospective study in Port Harcourt which showed *Klebsiella pneumonia* as the predominant isolate (17). S.aureus was the main bacteria isolated from CSF during the study period, and this is in keeping with the result of a previous study in Jos, Nigeria (18). The same study reported the absence of *E.coli* from CSF (18) . *E.coli* is a known cause of neonatal meningitis (3). The reason for this is not clear, and may require further studies. Although, the coagulase negative staphylococci (CoNS) that were isolated were recorded as pathogens they may as well represent contaminants. Difficulties exist in some cases in the differentiation of CoNS infection from culture contamination in clinical specimen because CoNS is a common skin commensal (19). Four of the isolates were candida specie from blood culture and soft tissue which might be responsible for infection in low birth weight neonates as observed in some previous studies(20,21). All the isolates in this study were from the late neonatal period and as such, it is difficult to determine whether *E.coli* is a common cause of infection in the early neonatal period or not. It is possible that delays in decision making by the paediatrician with respect to submission of neonatal specimen for analysis whenever they suspect neonatal infection within 72 hours, may have inadvertently moved early onset infections into late onset period.

The antibiotics resistant pattern in the *E.coli* isolated in this study cannot be interpreted with a high degree of certainty because not all the isolates were equally tested for resistance to the same classes of commonly used antibiotics in our laboratory. However, based on the available data, most of the isolates are resistant to amoxicillin, amoxicillin-clavulanate in agreement with previous studies (9,22,23). Most were also resistance to the third generation cephalosporins with few of the E.coli isolates showing resistant pattern resembling ESBL producers; the prevalence of which has been reported in other studies as11.4% (2009)and 3.8%(2012) by Iroha et al from Enugu (24,25) , while 76.9% was report from Ibadan in 2012(28). The tested isolates were susceptible to imipenem and this agrees with previous studies (9,25,26,27). This may suggest that strains that elaborates carbapenemase enzyme may not be common in this locality. Studies have shown that most *Enterobacteriaceae*, *E.coli* inclusive; even the ESBL-producing strains, are still susceptible to the carbapenems (25,26,27,28).

Seven of the *E.coli* strains tested against amikacin were susceptible. Of these seven isolates, three were tested against imipenem, out of which two were susceptible and one was resistant. Amikacin and

imipenem were the most active antimicrobial agent against isolates of *E.coli* as found in other studies (27,28).

In conclusion, *E.coli* is the fourth most common bacteria isolated in the neonatal period in this study and third among the gram negative bacteria. Most were resistant to commonly used antibiotics for treatment of neonatal infections with a few showing resistant pattern resembling ESBLs producers. Most of the isolates were susceptible to amikacin and the carbapenems. In view of the limitation encountered in this study, a well designed prospective study; as well as continuous surveillance of antimicrobial resistance in *E.coli* isolates are hereby recommended.

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