http://jmscr.igmpublication.org/home/
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v9i7.14

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Prevalence of MDR Pathogens in Urine of Paediatric Patients in a Tertiary Care Hospital

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Abstract

Introduction: *Nowadays, antimicrobial resistance is a challenge faced by physicians globally. Infections due to Multidrug Resistant Organisms (MDROs) is a significant problem in Paediatric Intensive Care Unit (PICU).*

Aim: *To identify the burden of antimicrobial resistance in hospital isolates from paediatric patients and elucidate the resistance pattern of MDROs.*

Material and Methods: *All the clinical specimen received from pediatric outpatient and inpatient were included in the study and data were collected and processed on blood agar, chocolate agar and MacConkey agar. Cled agar from those yielding growth on urine culture. The bacterial isolates were identified with standard bio-chemical tests. Antibiotic susceptibility testing was done according to CLSI guidelines 2019 by Kirby Bauer disk diffusion method.*

Results: *A total of 100 (39.07%) bacteria were isolated from 256 clinical samples, 65 bisolates were from urine followed by blood (22), exudates (9) and respiratory (4) samples. 22 were MDROs,14 were from urine, blood(5), exudates(2) and respiratory(1) samples respectively. Isolates of E. coli (54%), Klebsiella spp (36%). and Enterococcus (0.9%) spp. were the common MDROs. The most sensitive antibiotic for gram negative bacteria was polymyxin-B (100%) followed by imipenem (98%) and meropenem (90%). And the most sensitive antibiotic for gram positive bacteria was Linezolid (100%) Vancomycin (97%) followed by Teicoplanin (94%).*

Conclusion: *This study reveals significant prevalence of MDR pathogens among paediatric population. E. coli, Klebsiella spp. and Enterococcus spp. were the common MDROs encountered in the study, mostly isolated from urine culture.*

Keywords: *Bacterial, Drug resistance, Escherichia coli, Urinary tract infection.*

Introduction

Antimicrobial resistance is on the rise, creeping into the paediatric population too. Infections due to MDROs is a significant problem in paediatric ICU. In developing countries, MDROs causing neonatal infections are increasing and this has been attributed to the production of Extended Spectrum Beta Lactamases (ESBLs), Amp C β-lactamases, carbapenemases and aminoglycoside modifying enzyme[1]. Sepsis due to MDROs is a significant problem worldwide[2] Klebsiella pneumoniae and Staphylococcus aureus have been

identified as the most common cause for neonatal sepsis in India. Prolonged hospitalisation, increased use of antimicrobials and vulnerability are some of the factors that favour neonatal colonisation with MDROs[3,4]. It has also been observed that MDROs causing Urinary Tract Infections (UTI) in the paediatric age group include mainly E. coli and Klebsiella spp[5]. Infections due to Multidrug-Resistance (MDR) Gram negative organisms are on the rise globally[6,7]. Although the most common pathogen in the NICU is Gram positive coccus, the incidence of bacteremia caused by Gram-negative bacilli (GNB) has increased in the past decades, and GNB bacteremia is often associated with a higher mortality rate[8,9,10]. The emergence of multidrug resistance (MDR) among these organisms deserves particular concern, because treatment options of antimicrobial agents for an MDR strain are often limited and inappropriate initial antibiotics will predispose these neonates to an especially high risk of severe sepsis and a poor outcome[11,12].

Material and Method

Material

256 Sample from paediatric patient will be collected. from inpatients admitted to the ICU and NICU were collected from Rama Medical college hospital and research centre study was conducted from January 2019 to December 2019.

Method

All the sample was collected from pediatric outpatient and inpatient were included and the study and data were collected in MacConkey agar Cled agar from those yielding growth on culture. The bacterial isolate was identified with standard bio- chemical test.

Preliminary identification was done with the help of the following methods:- Gram Stain:- The suspected colonies were stained using gram stain method and their shape, colour and arrangement were observed under light microscope.

Procedure of Gram Staining: -Gram Staining is a differential staining and it consist of four steps: Primary stain (crystal violet) for 1 minute. Mordant (gram,s iodine) for 1 minute. Decolourizer is – (acetone) for 5 sec. Counter stain (safranin) for 30 s

Inclusion Criteria: Paediatric patients with clinical infection and sample, Pus, Urine, Blood, Body fluid will be collected. Social demographic date, medical history, clinical history regarding age, gender type of paediatric patient percentage and antibiotic therapy will be taken.

Exclusion Criteria: Repeat isolates from the same patients and from the same site/specimen all excluded.

Biochemical Tests Catalase Test

Principle -

This test demonstrates the presence of catalase an enzymes that catalyses the release of oxygen from hydrogen peroxide.

Procedure- Take a clean grease free slide. Divide it into two halves. One half serves at test and the other as control. Put one drop of 3% H202 each on the test and control halves Now, with the help of wooden stick a separate colony from the culture plate and touch on the surface of H2O2 marked as test. Look for the effervescence production. P.C-ATCC Staphylococcus aurous (25923) N.C-ATCC Enterococcus faecal is (29212)

Statistical Analysis

Statistical analysis was performed by using computer-based software, Statistical Package for Social Science (SPSS). Mean values of parameters were compared to determine.

Observation & Result

In out of 256 total 100 sample were found with various bacterial growth which mean finding of bacteria was 39.88% in our study. In which the finding of different type of bacteria was *E.coli* (18.35%), *Klebsiella spp* (7.42%) *Pseudomonas aeruginosa* (5.46%), *CONS* (5.46%), *Enterococcus spp* (14.84%), *Stapylococcus aureus* (7.03%).

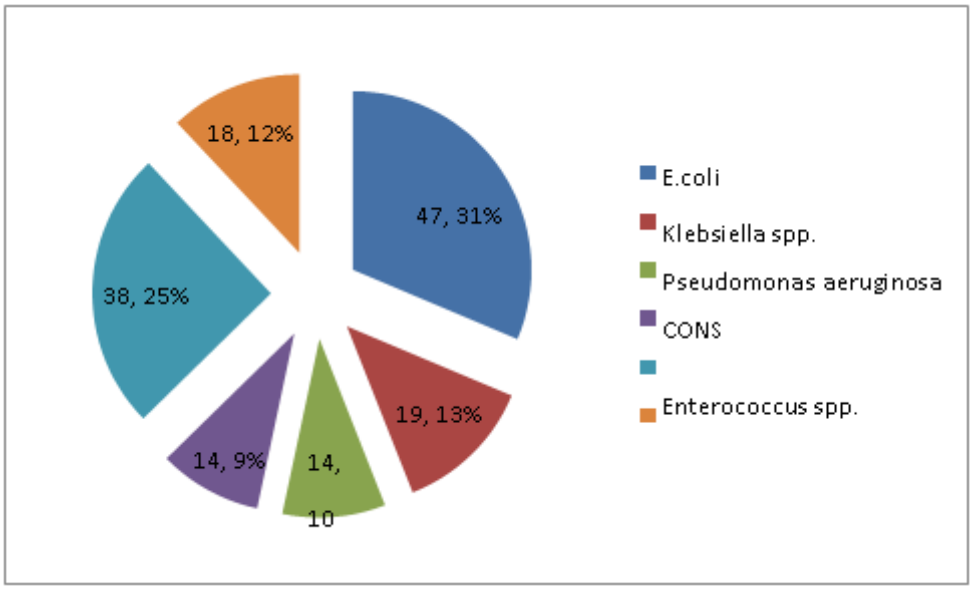

Fig No 1 Number of different bacteria found in total 150 sample

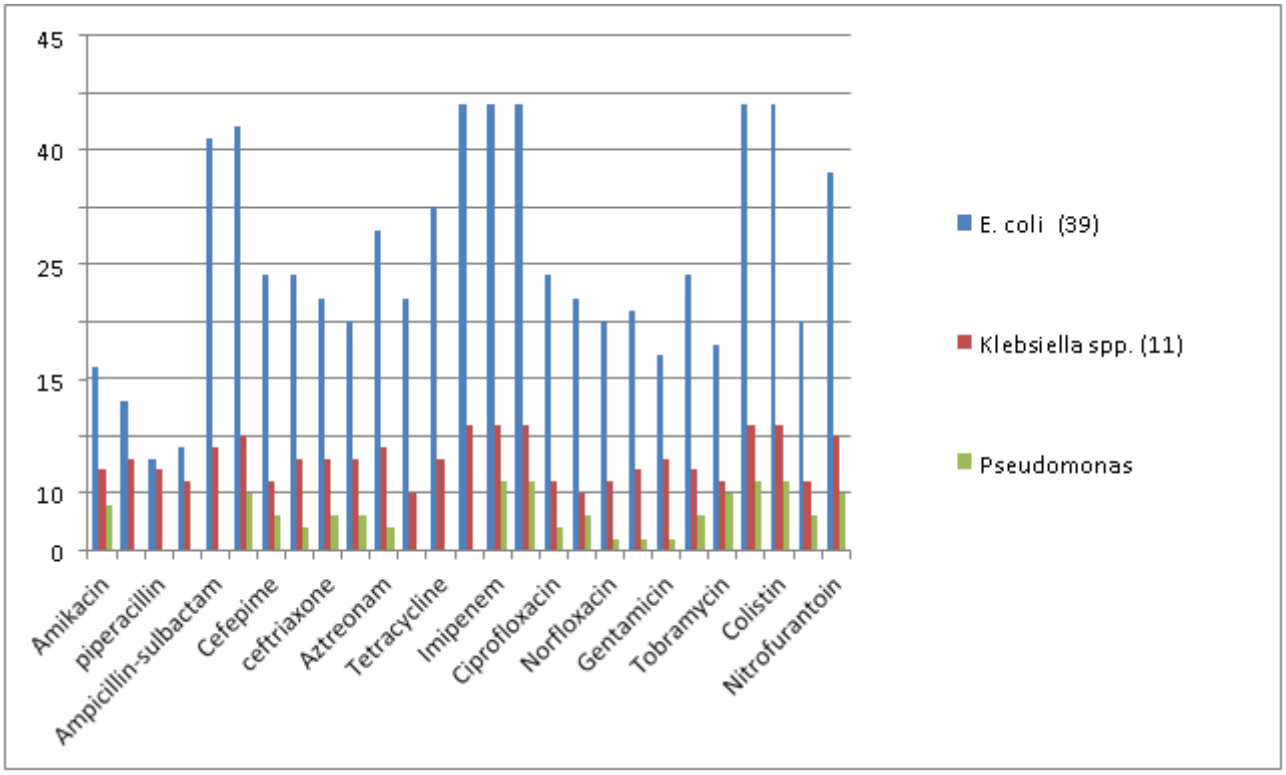

Fig No 2 bar chart showing antibiotic sensitivity for gram negative cocci

In case of *E.coli*, Polymyxin-B, colistin, Imipenem, Meropenem, Tigecycline, showed 100% Sensitivity followed by Amplicillin sulbactam (83%), Piperacillin tazobactam (93%), Nitrofurantion (93.25%).

In case of *Klebsiella spp.*, Polymyxin-B, colistin, Imipenem, Meropenem, Tigecycline, showed 100% Sensitivity followed by Amplicillin sulbactam (83%), Piperacillin tazobactam (93%), Nitrofurantion (93.25%), Netilmycin (75%).

In case of *Pseudomonas aeruginosa*, Polymyxin-B, colistin, Imipenem, Meropenem, showed 100% Sensitivity followed b, Piperacillin tazobactam (93%), Nitrofurantion (93.25%).

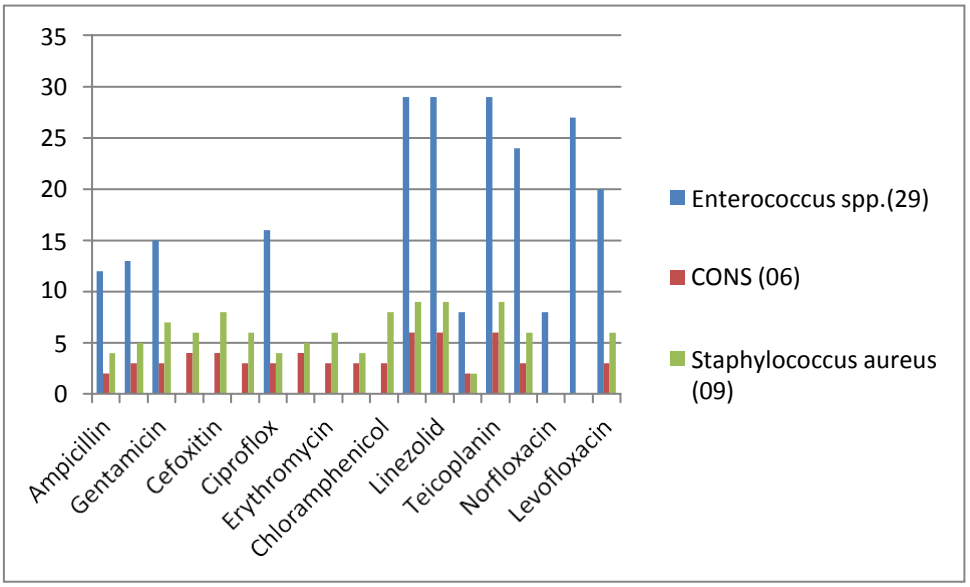

Fig 3 showing the antibiotic sensitive for gram positive coci

In case of *Enterococcus spp*., Vancomycin Linezolid, Teicoplanin showed 100% sensitivity followed by, Tetracycline (75%), Nitrofurantoin (75%). In case of *CONS*, Vancomycin Linezolid, Teicoplanin showed (100%) Sensitivity followed by, Tetracycline (75%), Cefoxitin (80%) & Levofloxcin (75%). In case of *Staphylococcus aureus*, Vancomycin Linezolid, Teicoplanin showed (100%) sensitivity followed by, Tetracycline (40 %), Cefoxitin (50%) & Levofloxcin (40%), Gentamicin (60%).

Discussion

In the study done by Durgesh et al7, Escherichia coli was the predominant (31.25%) isolates causing UTI, followed by Staphylococcus aureus (25%), Pseudomonas aeruginosa (15.62%), Proteus mirabilis (15.62%), Klebsiella pneumoniae (6.25%) and Serratia marcescens (6.25%) where as in our study the most common organism causing UTI was *Escherichia coli* (15.23%) isolates followed by *Enterococcus spp.* (11.23%), *Klebsiella sppecies* (4.29), *Staphylococcus aureus* (3.51%), *Pseudomonas aeruginosa* (2.34%), *CONS* (2.34).

Similarly, in the study done by Yolbaset al6 and Mostafa et al[8] and, Escherichia coli was the most common organism causing urinary tract infection followed by Klebsiella which was similar to our study. Similar results were observed in studies done by Rehamanet al9 and CWkwan et al[10]. This difference may be due to the variation in geographical distribution.

Study done by Haller et al showed the effective empirical intravenous and oral antibiotics for the treatment of community-acquired UTIs include Ampicillin and Aminoglycosides[11], whereas the oral antibiotic of choice by Prais D et al[12] and Hoberman et al[13] showed Amoxicillin-Clavulanate or Cefuroxime and Cefixime respectively.

Compared to the study done by Yolbas et al6, in which Escherichia coli was resistant to Amikacin in 3%, Nitrofurantoin 9%, Trimethoprim/ Sulfamethoxazole 58% and Cefotaxime 51%, in our study Escherichia coli showed more resistant pattern to these antibiotics i.e Amikacin (15.6%), Nitrofurantoin (46.8%), Cotrimoxazole (68.75%) and Cefotaxim (81%). The reason for increase in resistance may be due to the excessive use of third generation Cephalosporins both as oral and intravenous route.

In the study done by Durgesh et al[7], the mean sensitivity to Penicillin and Ciprofloxacin were 70.83% and 60% respectively. Staphylococcus aureus showed 75% resistance to Methicillin, Oxacillin and Vancomycin. Uropathogens were sensitive to Norfloxacin, Co- trimoxazole and

Ofloxacin. These results were in contrast to our study in which Escherchia coli was sensitive to Amoxycillin and Ciprofloxacin in only 6% and 15.6% respectively, and in case of Klebsiella pneumoniae none was sensitive to Amoxycillin and only 40% were sensitive to Ciprofloxacin. The reason for this difference may be due to the injudicious over the counter use of antibiotics.

In the study done by Mostafa et al[8], Escherichia coli had a sensitivity rate of 97.8% to Ceftriaxone and 95.2% to Cefotaxime in contrast to our study in which Cefotaxim was sensitive only in 18.7% of cases. The highest resistance rate of Escherichia coli was to Penicillin (95.2%) followed by Amoxycillin and Cotrimoxazole (79 and 74.2% respectively) in the study by Mostafaet al11 whereas in our study Escherichia coli showed high resistant to Amoxycillin (93%) followed by Nalidixic acid (87.5%). According to Mostafaet al8 Klebsiella spp. showed the highest sensitivity to Ciprofloxacin (95.1) and Ceftriaxone 90.7% which was in contrast to our study in which Klebsiella was sensitive to Ciprofloxacin and Cefotaxim only in 40% and 30% respectively. in our study Klebsiella showed highest resistant to Amoxycillin which was similar to study done by Mostafa et al[8].

In Study done by Reham et al[9], 59.9% isolates of Escherichia coli were multidrug resistant where as in our study only one Escherichia coli was multidrug resistant. In our study Escherichia coli showed increase in resistant to oral antibiotics; Amoxycillin (93%), Ofloxacin (81.2%), Ciprofloxacin (84.3%) Cotrimoxazole (68.75%), and Nitrofurantoin (46.8%) which was similar to the results in study done by Reham et al[9]. The reason may be easy access to oral antibiotics from pharmacy.

In our study E. coli was sensitive to Cefotaxim in only 18.75% where as in study done by CW Kwan et al10, Escherichia coli was sensitive to greater than 95% of third-generation Cephalosporins (Ceftriaxone and Ceftazidime). In their study bacteria were frequently resistant to ampicillin (54.4%) and Trimethoprim-Sulfamethoxazole (40.4%) which was comparable to our study.

In our study Escherichia coli (81.2%) and Klebsiella pneumoniae (70%) showed increase in resistance pattern to Cephalosporins which was comparable to study done by Stephanie A et al14 in which there was high rate of resistance to third generation Cephalosporins in subpopulations of children admitted to the hospital for UTIs.

In the study done by Rasoulet al15, most isolates showed high resistance against Ampicillin, Cotrimoxazole, Nalidixic acid, and Nitrofurantoin and Klebsiella isolates showed more resistance against tested antibiotics than Escherichia coli isolates which was comparable to our study.

Although our study suggested high resistance to oral antibiotics, there was a caveat that this study included in-patients only. This might have caused some selection bias. However, this information raises an important issue regarding antibiotic resistance in UTI. A future study including both in-patients and out-patients would help clarify if resistance to oral antibiotics has indeed emerged in the organisms causing UTI in the community.

Conclusion

This study reveals significant prevalence of MDR pathogens among paediatric population ESBL (E.coli), MBL (P.aeruginosa), MRSA (Staphylococcus aureus) & VRE (Enterococcus spp.). E. coli, Klebsiella spp. and Enterococcus spp. were the common MDROs encountered in the study, most of the isolates were from urine culture. MDROs are present among outpatients as well, warranting judicious use of antibiotics and adequate infection control measures to prevent spread of these potential pathogens.

Knowledge of the antibiotics susceptibility pattern of the isolates from paediatric patient infection is crucil for planning the appropriate treatment of these cases prior to getting the susceptibility reports from the laboratory

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