

# Investigation of antimicrobial resistance in urinary tract infection in children at the east party of democratic Republic of Congo

## Abstract

Urinary tract infection (UTI) is one of the most common pediatric pathology in childhood. Knowledge of local antimicrobial resistance is essential to guide empiric anti biotherapy and biotherapy in treatment of UTI in children.

**Aim:** To determine anti bio resistance profile in the children urinary tract infection in our area study.

**Methods:** This is a retrospective study designed and conducted from January 1st to December 31, 2018 at North-Kivu Provincial Hospital. All children with urines cultures positives result were included in this study. Isolated bacteria and antimicrobial susceptibility tested were by using biochemical methods.

**Results:** *Proteus Mirabilis* were the main gram negative bacteria isolated in 41.2% and *Enterobacteria spp* 17.6% the most gram positive bacteria identified. All bacteria are resistant to ampicillin.

**Conclusion:** Antibiotic resistance in children urinary tract infection, must be regularly studied in order to choose rationally the best empiric antibiotic used.

**Keywords:** urinary infection, empiric antibiotic, antimicrobial resistance, children

Volume 7 Issue 3 - 2019

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**Received:** May 04, 2019 | **Published:** May 21, 2019

## Introduction

Urinary tract infection is one of the common diseases in childhood with worldwide prevalence of 2-20%.<sup>1,2</sup> This pathology represents an important source of using empiric or irrational antibiotic initially because of absence of specific symptom, signs and microbiological confirmation in most of cases.<sup>3-5</sup> Urinary tract infection area important public health problem in children, if treatment is inadequate, this affection exposure children to high morbid-mortality, renal scarring, renal abscess formation, hypertension, septicemia, pyelonephritis and chronic renal failure,<sup>6,7</sup> antimicrobial resistance<sup>8,9</sup> and other complications.<sup>10</sup> In developed countries initial choice of antimicrobial therapy is based on knowledge of the predominant pathogen in the patient's age group, antibiotic sensitivity patterns in the practice area, clinical status of patient and the opportunity for close follow-up<sup>4,10</sup> compared to several Sub-Saharan African countries, in which urinary tract infection are treated without microbiological result and studies beforehand because of people poverty. In Democratic Republic of Congo, few studies report on children urinary tract infection<sup>11</sup> and in North-Kivu Province this children pathology is usually treated empirically because of lack standard therapeutic guideline and local susceptibility data. This's how, in this study aims to report bacteria and antimicrobial resistance profile of children urinary tract infection in our area study.

## Materials and methods

### Type and study period

The present study is retrospective, non-randomised and convenient

sampling. This study was conducted from January 1st, to December 31, 2018 and reviewed children aged from 0-15years with urine culture result.

### Area study

The study was conducted at pediatric department of North-Kivu Provincial Hospital, which is the health reference center of North-Kivu Province. It has 205beds capacity for all Hospital. Pediatric department use one professor, four pediatrics specialists, five doctors and an important nursing staff. North-Kivu Provincial Hospital has an excellent microbiological laboratory of this party of Democratic Republic of Congo.

### Population study

All children with urinary tract infection symptoms or signs such as in explained fever recurrent abdominal pain, malodorous urine, urinary frequency, cloudy urine, nocturnal enuresis,<sup>12,13,15</sup> suboptimal weight gain, prolonged jaundice, irritability and vomiting in neonates<sup>14,16</sup> constitute our population study.

### Inclusion criteria

All children with urines cultures positives and susceptibility result were included in this study.

### Exclusion criteria

We excluded in this study, children with negative urine culture and without susceptibility result. Also, catheterized children were excluded.

## Urinary samples

Urinary samples were collected in sterile containers following standard biochemical test.<sup>11,4</sup> Each specimen was freshly reviewed under microscopy, colored with gram, sowed on Cysteine Lactose Electrolytic Deficient, Incubated 24 hours, purity gram stain, identification bacterial and analysed susceptibility drugs. Isolated bacteria were tested by using the disk diffusion method on Muller Hinton Agar. Result were interpreted according European Standard.<sup>17</sup> Following antibiotics were tested: Ampicillin(AMP), Amoxicillin(AMC), Gentamycin(GN), Nitrofurantoin(NIT), Ciprofloxacin(CIP), Ceftriaxone(CRO), Cloxacillin(CL), Oxacillin(OX) and Cefepime(CEP).

## Statistical analysis

Statistical analysis was performed by using the SPSS statistical package version 20.0, Microsoft Windows and Excel 2016. Differences in group proportions and categorical variables were assessed by using Chi-square test. A p-value<0.05 was considered as statistically significant.

## Ethical approval

Approval was obtained by North-Kivu Provincial Hospital authority and anonymity sample was analysed in order to ensure confidentiality in this study.

## Results

Table 1–Table 4.

**Table 3** Antibiotic resistance tested (ART)

Ac	<i>Proteus</i> n=14	<i>G- Bacteria</i> <i>Pseudomonas</i> n=8	<i>E.coli</i> n=5	<i>Citobacter</i> n=3	<i>Yersinia</i> n=1	<i>G+ Bacteria</i> <i>Enterobacteria</i> n=6	<i>Other</i> <i>Bacteria</i> n=2
AMP	14(100)	4(50)	5(100)	3(100)	1(100)	6(100)	2(100)
AMC	1(7.1)	2(25)	1(20)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
GN	3(21.4)	2(25)	1(20)	3(100)	1(100)	2(33.3)	0(0.0)
NIT	3(21.3)	0(0.0)	0(0.0)	0(0.0)	1(100)	3(50)	0(0.0)
CIP	2(14.3)	0(0.0)	0(0.0)	1(33.3)	1(100)	0(0.0)	0(0.0)
CRO	1(7.1)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(16.7)	0(0.0)
CL	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(100)
OX	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(100)
CEP	1(7.1)	0(0.0)	1(20)	0(0.0)	0(0.0)	0(0.0)	2(100)

Resistance to Ampicillin was also 100%.

**Table 4** Multidrug resistance pattern Gram negative bacteria

Drugs resistance	<i>Proteus</i> n=14(100)	<i>Pseudomonas</i> n=8(100)	<i>E. coli</i> n=5(100)	<i>Citrobacter</i> n=3(100)	<i>Yersinia</i> n=1(100)
AMP	14(100)	4(50)	5(100)	5(100)	1(100)
AMP,AMC	1(7.14)	2(25)	1(20)	1(33.3)	0(0.0)
AMP,AMC, GN	1(7.14)	2(25)	1(20)	1(33.3)	0(0.0)
AMP,AMC, GN, NIT, CIP, CRO, CEP	2(14.3)	0(0.0)	0(0.0)	0(0.0)	0(0.0)

This table show that multidrug pattern Gram negative bacteria.

**Table 1** Characteristic of children

Characteristic	N=39	100%
Age		
2month-2years	06	17.6
3-5years	13	38.2
>5year	15	44.1
Gender		
Male	13	38.2
Female	21	61.8

44.1% of children were over 5years old. Female was 61.8% with significant difference p<0.05. Sex ratio was 0.61.

**Table 2** Bacteria isolates in urinary tract infection in children

Bacteria isolates	N= 39	100%
Gram negative		
<i>Proteus mirabilis</i>	14	41.2
<i>Pseudomonas aeruginosa</i>	08	23.5
<i>E. coli</i>	05	12.8
<i>Citrobacter</i>	03	8.8
<i>Yersinia enterocolitica</i>	01	2.9
Gram positive		
<i>Enterobacter spp</i>	06	17.6
<i>Enterocoques fecalis</i>	01	2.9
<i>Staphylococcus spp</i>	01	2.9

Mean gram negative bacteria were isolated in urinary tract infection especially: *proteus mirabilis* 41.2%, *pseudomonas aeruginosa* 23.5 %, *E. coli* 12.8%.

## Discussion

A total of 97 urines samples were reviewed in this study. 39 urines cultures were positives. 44.1% of children were over 5 years old. Several authors reported similar results.<sup>4</sup> This study revealed a higher incidence of urinary tract infection in female sex 61.8% than male with sex ratio of 0.61. Our result, in this regard was compared to that reported in Nigeria<sup>18</sup> and Ethiopia.<sup>19</sup> This higher prevalence of urinary tract infection could be explained by short urethra anatomy in female, proximity of reproductive and urinary organs with anus and inadequate perineal hygiene. The first attack occurring in girls by 5 years, peaking during infancy life. While it's common in boys during the first year of life especially among those who are uncircumcised.<sup>20,21</sup> In girl, education ongoing perineal hygiene must began at this age. In our series, mean gram negative bacteria were isolated in urinary tract infection especially: *protease mirabilis* 41.2%, *pseudomonas aeruginosa* 23.5 %, *E. coli* 12.8 % and the common gram positive bacteria were *Enterobacteria saprophytic* 17.6%. Similar result was found by other authors in different proportion.<sup>8,11</sup> In urinary tract infection, common causative organisms are from the intestinal flora in children age.<sup>22-24</sup> *Proteus mirabilis*, is more common in boys than in girl's urinary tract infection.<sup>25</sup> This is not confirmed in our study and we did not find a serious explanation for this difference in all the revised literature. However, in boys per urethral colonization is an important favouring factor of urinary tract infection in this case. Also, preputial space is potential reservoir of bacterial pathogens for uncircumcised boys. Higher antibiotic resistance rate were noted against frequently with ampicillin (100%) in most cases, amoxicillin and gentamycin, which are more antibiotic used in the first empirical choice in our countries. This problem could be overall; prevalence of antimicrobial drug resistance was lower than recently reported study in neighboring countries. For example, in Rwanda, recently author reported higher resistance rate for ampicillin, amoxicillin, norfloxacin and ciprofloxacin, higher to resistance rates reported in South-Kivu neighbouring province<sup>11</sup> compared to our study.<sup>26,27</sup>

Multidrug-resistance to antibiotic in Gram-negative bacteria, especially with Enterobacteriaceae has become a serious problem in many regions of the world and require treatment with reserve drugs,<sup>28-31</sup> and some new drug which are inaccessible financially to the common people especially in Sub-Saharan African countries. Beta lactams resistance (Table 4) is a good proof marker for these situations. In our context, people have poor living condition, poverty which contributor low level education and barriers to health services. All these factors promote self-medication with antibiotic in particular beta lactams. This practice selects multi resistant organism and explains withdrawal of ampicillin oral form on the Congolese market by government our study has limitation because it was performed in a tertiary referral hospital for North-Kivu province. Patient who arrive at North-Kivu Provincial Hospital have several comorbidities initially treated with empiric antibiotic at secondary medical structure. This would influence the prevalence of antimicrobial resistance observed in our area study.<sup>32,33</sup>

## Conclusion

Antimicrobial resistance rate change over time highlighting, the need for continued monitoring of the susceptibility patterns of urinary tract infection. This study shows a variable profile of bacteria and antimicrobial resistance that should guide the empiric choice of antibiotic locally for treatment of urinary tract infection in children.

## Acknowledgments

None.

## Conflicts of interest

Author declares that there is no conflict of interest.

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