

Profile and Antibiotic Sensitivity of Acute Pyelonephritis in Children at Gabriel Toure Teaching Hospital, Bamako

Djénéba Konaté^{1*}, Lala N'Driany Sidibé¹, Karamoko Sacko¹, Bakary Koné¹, Adama Koné², Aminata Doumbia¹, Fatoumata Tiero¹, Pierre Togo¹, Fatouamata Léonie Diakit¹, Abdoul Karim Doumbia¹, Belco Maïga¹, Fousseyni Traoré¹, Aamadou Touré¹, Hawa Diall¹, Mohamed Elmouhouloud Cissé¹, Adama Dembélé¹, Oumar Coulibaly¹, Yacouba Aba Coulibaly¹, H. Konaré¹, Isabelle Traoré¹, Guédiouma Dembélé¹, Issiaka Koné¹, Leyla Maïga¹, Ibrahima Ahamadou¹, Abdoul Aziz Diakit¹, Boubacar Togo¹, Mariam Sylla¹, Fatoumata Dicko-Traoré¹

¹Pediatric Department, CHU Gabriel Toure, Bamako, Mali

²Pediatric Unit, Hospital Center Mother-Child, Luxembourg, Luxembourg

Email: *djeneba.konate@yahoo.fr

How to cite this paper: Konaté, D., Sidibé, L.N., Sacko, K., Koné, B., Koné, A., Doumbia, A., Tiero, F., Togo, P., Diakit, F.L., Doumbia, A.K., Maïga, B., Traoré, F., Touré, A., Diall, H., Cissé, M.E., Dembélé, A., Coulibaly, O., Coulibaly, Y.A., Konaré, H., Traoré, I., Dembélé, G., Koné, I., Maïga, L., Ahamadou, I., Diakit, A.A., Togo, B., Sylla, M. and Dicko-Traoré, F. (2020) Profile and Antibiotic Sensitivity of Acute Pyelonephritis in Children at Gabriel Toure Teaching Hospital, Bamako. *Open Journal of Pediatrics*, 10, 94-108.

<https://doi.org/10.4236/ojped.2020.101008>

Received: December 20, 2019

Accepted: January 19, 2020

Published: January 22, 2020

Copyright © 2020 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

Background: Very common symptom in children, fever, perhaps a warning sign of more or less severe pathology, rapidly progressive, including an invasive bacterial infection such as acute pyelonephritis (APN). The aim of this work was to study the bacteriological profile and antibiotic sensitivity of APN in children. **Methods:** A prospective study involving any infant or child aged 3 months to 15 years with an acute fever ($\geq 38^{\circ}\text{C}$) in which a urine test strip was performed in the pediatric department of the teaching hospital Gabriel Toure between April 1st and May 15th, 2019 (45 days). **Results:** 124 children were included out of 244 febrile patients. Infants (3 - 23 months) predominated (52.8%) with a sex ratio of 2. Seventy-five percent of children came directly from home and 30.6% were on antibiotic prior to admission. The urine bag sample was taken in 55.6% and the urine was macroscopically cloudy in 32.3%. Stigmas of urinary tract infection at the urinary strip were present in 56.5%. Confirmation of acute pyelonephritis (APN) by CytoBacteriological Urine Examination (CBUE) was 29% with *Escherichia coli* (63.9%) or *Enterococcus faecalis* (30.5%). Sensitivity was excellent for ciprofloxacin and imipenem (100%). The overall resistance was greater for gentamicin, cotrimoxazole, ceftriaxone, cefotaxime and amoxicillin-clavulanic acid (Threshold: 17.9% - 95.6%). APN was associated with bacteremia in 2.8% with hospitalization for 45.2% and mortality of 11.1% (due to severe acute malnutrition, severe dehydration and multifocal infection). **Conclusion:** The APN, daily ac-

tivity of pediatrician in Bamako, is observed in one third of febrile children associated with a major life-threatening condition of risk factors, then the likely antibiotherapy could be amikacin in our context.

Keywords

APN, Fever, Child, Bamako

1. Introduction

Fever is an extremely common symptom in children [1]. As the leading cause of consultation in pediatric emergencies (15% to 20% in developed countries, higher in Africa), fever most often goes with minor and common self-limited infectious diseases [2]. It can be a warning sign of more or less severe and rapidly progressive pathology including an invasive bacterial infection such as acute pyelonephritis (APN).

Febrile urinary tract infection or APN is responsible for 95% of fever above 39°C before 2 years [3]. It is the severe bacterial infection (threatening renal parenchyma with risk of renal scarring or even long-term renal failure) the most common in pediatrics [4].

The diagnostic key remains the Cyto-Bacteriological Urine Examination (CBUE), which must be preceded by a urine test strip (UTS) in any febrile infant. The management of APN is well codified and relies on early and adapted antibiotic treatment.

During 2014 in Caen, 219 cases of PNA diagnosed in children, 18.3% of which were less than 3 months old and 16.4% of recent consumption of antibiotics. *E. coli* isolated in 80.3% and *E. faecalis* in 5.6%. The total sensitivity was 33.5% to the antiogram [5].

In the pediatric department of the teaching hospital Gabriel Toure, no study was carried out on acute pyelonephritis in children hence the realization of this work was intended, on the one hand, to clarify the bacteriological profile and sensitivity to antibiotics of APN in children.

2. Methods

This was a prospective, single-center study that involved infants and febrile children aged at least three months to 15 years of age observed in the pediatric department of CHU Gabriel Toure in Bamako from April 1st to May 15th, 2019 (45 days), on whom UTS and CBUE were performed with parents' consent.

Every febrile infant or child admitted to the pediatric department was registered and underwent careful clinical examination. Complementary examinations at the entrance systematically included a urine test strip which when positive for stigmas of a urinary infection (positive leukocytes and/or positive nitrite), has been associated with samples for bacteriological studies (a CBUE ± a blood culture with culture and antibiogram) and biological (a hemogram, a protein of in-

flammation CRP). When at the UTS there is no stigma of urinary infection (negative leukocytes and/or negative nitrite), the samples for bacteriological and biological studies of the urinary infection (UI) have not been made. Other examinations (serum creatinine, serum electrolytes, kidney and urinary tract ultrasonography should be) were made according to the context.

Has been considered as:

- Acute fever: any temperature greater than or equal to 38°C appeared less than 7 days before admission.
- Urinary bacterial infection: any urine sample after CBUE that meets the following three biological criteria:
 - leukocyturia $\geq 10^4$ /ml,
 - a single bacterial species,
 - a bacteriuria in culture whose threshold will differ according to the method of sampling.
- ❖ peroral sampling: threshold $> 10^5$ UFC/ml.
- ❖ sample collection: threshold $> 10^3$ UFC/ml.
- APN: any febrile bacterial urinary infection.

Broad-spectrum antibiotic therapy (either mono- or bi-therapy IV or oral monotherapy) was initiated early in case of stigmas in UTS then secondarily adapted according to the antimicrobial susceptibility test. The patient (hospitalized or outpatient) was followed up to 15 days after admission. The criteria of cure were the disappearance of the fever, the normalization of the appearance of the urine after treatment and the amendment of the clinical signs to the admission.

The urine collection method used is that of the middle of the jet for the big child, the self-adhesive pouch for the infant and the small child and the bladder sounding for the comatose children. Each urine received at the laboratory was subject to a cytobacteriological examination and the identification was carried out according to the morphological, cultural and metabolic characters of the germs. The antibiotic resistance test was performed according to the recommendations of the Committee of the antibiogram of the French Society of microbiology (CA-FSM) [6]. The data were collected on a standardized survey sheet previously tested and focused on: the identity of the patient, socio-demographic characteristics of children and their parents, clinical examination, complementary examinations and evolution.

Then, they were entered on SPSS 22.0 and analyzed by using Pearson's Chi2 and Student's t for the different comparisons. The threshold of p considered significant was set at less than 5%.

3. Results

From April 1st to May 15th, 2019, 1908 children aged between 03 months and 15 years were observed in the pediatric department of the teaching hospital Gabriel Toure and 244 children had at least 38°C fever. Of the febrile children, 124 were included in our study, of whom 36 confirmed cases of acute pyelonephritis with a frequency of 29% (36/124).

Characteristics of children with APN

The sex ratio was 2 (24 boys/12 girls) with a predominance of infants (58.3%) for an average age of 22 months. Three out of four children came directly from home and almost one-third (30.6%) were on antibiotics before admission. The clinical picture was dominated by transit disorders (64.5%) with its complications: dehydration (17.1%) and oliguria (6.6%) **Figure 1**. The rest of the characteristics are summarized in **Table 1**.

Biological characteristics of children

At the hemogram, hyperleukocytosis with polynuclear neutrophils was observed in 50% of cases, monocytosis (monocytes > 1000 elements/mm³) in 55.6%. C Reactive Protein (CRP) was positive in 84.4% with an average of 47.70 mg/l and a maximum of 363.53 mg/L.

Bacteriological characteristics and germ sensitivity

The urine bag sample was taken in 55.6% and the urine was macroscopically cloudy in 32.3%. The mean leukocyte count was 33,853 leukocytes with a maximum of 580,000 cells/mm³. Confirmation of APN by CBUE was made in 29% with presence of *Escherichia coli* (63.9%) or *Enterococcus faecalis* (30.5%) or *Klebsiella pneumoniae* (2.8%) or *Enterococcus faecium* (2.8%). Sensitivity was excellent for ciprofloxacin and imipenem (100%). The overall resistance was major for gentamicin, cotrimoxazole, ceftriaxone, cefotaxime and amoxicillin-clavulanic acid (threshold: 17.9% - 95.6%). APN was associated with bacteremia in 06.3% with hospitalization for 45.2% for a mortality of 11.1% (severe acute malnutrition, severe dehydration and urinary and meningeal and urinary and cardiacmultifocal infection).

Antibiotic therapy was subsequently adapted in 58.3% of cases. Seventy-five percent of the prescribers were physicians in pediatric specialization, 14% were acting as interns and 11% were pediatricians.

Table 1 summarizes the characteristics of children with APN.

Seventy-five percent of the prescribers were doctors in the pediatric specialization field. The dual antibiotic therapy Ceftriaxone + Gentacine and Cefotaxime Gentamicine were respectively prescribed in 69.4% and 19.4% (**Table 2**).

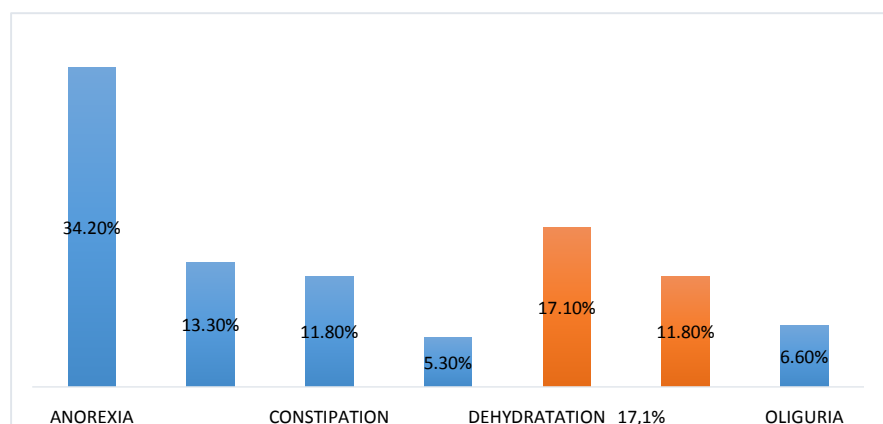


Figure 1. Clinical signs on admission outside fever.

Table 1. Characteristics of children with acute pyelonephritis.

Education level and parental occupations	Number		Percentage
Fathers not in school	18		50
Father's profession			
o traders/workers	22		61.1
o Officials	08		22.2
o Other	06		16.7
Mothers not in school	24		66.7
Profession of the mothers			
o Housewives	28		77.8
o Officials	04		11.1
o Shopkeepers/students	04		11.1
Characteristics of children			
Sex ratio (boys/girls)	24/12		2
Not circumcised	6/24		25
Age	Boys	Girls	
o 3 - 23 months	13	8	58.3
o 24 - 59 months	06	00	16.7
o 60 - 119 months	05	02	19.4
o 120 - 180 months	00	02	05.6
Come directly from home (without reference)	27		75
Recent exposure to antibiotics (before admission)	13		36.1
o Cotrimoxazole	03		21.4
o Ceftriaxone	02		14.3
o Amoxicillin	05		35.7
o Amoxicillin-clavulanic acid	02		14.3
o 1st generation cephalosporin	01		07.1
o Metronidazole	01		07.1
Particularities of the land			
o Drained hydrocephalus	02		40
o Psychomotor development delay	02		40
o Congenital heart disease type inter ventricular communication	01		20
o Urine collection per bag	20		55.6
o Macroscopic appearance disorder of the urine	29		80.5
Blood count			
o Hyperleukocytosis at Neutrophils	18		50
o Monocytosis > 1000/mm ³	20		55.6

Continued

CRP		
○ Positive	30	84.4
○ Negative	06	15.6
○ Blood culture	16/36	
○ Positive	1/16	06.3
○ Negative	15/16	93.7
Number of hospitalized children	17	47.2
Outcome		
○ Living	32	88.9
○ Death	04	11.1

Table 2. Distribution of children prescriber profile and first-line antibiotic therapy.

Prescriber Profile	Percentage	Antibiotherapy	Number	Percentage
Doctors in specialization	75	Ceftriaxone + Gentamicin	25	69.4
Pediatric doctors	11	Cefotaxime + Gentamicin	7	19.4
DIF	14	Cefotaxime	4	11.2
		Total	36	100

DIF: Doing internal function.

4. Discussion

During the study, we encountered certain difficulties:

- the realization of blood culture in certain patients for lack of financial means,
- the non-feasibility of the CBUE during working days after 4 p.m. and on weekends,
- the fairly long deadline for reporting the CBUE results, at least 4 days.

The limits of this work are explained by the fact that most of the patients are not insured (in particular the complementary examinations), our health structure was not equipped with an apparatus performing the ECBU and the unavailability of laboratory technicians.

Cosmopolitan pathology, more common in children, APN, constitutes a diagnostic and therapeutic emergency because of the renal prognosis, updating the local bacteriological profile and sensitivity to antibiotics play a key role in optimizing this therapeutic emergency. Thus, this study has permitted us to determine the place of APN during fever in children at CHU Gabriel Toure and local epidemiological and bacteriological data of APN.

On the epidemiological level:

Our results are consistent with those of similar studies: the APN affects all age groups of children but infants from 03 to 23 months were the most concerned. This could be explained by the sudden weaning done at this age, thus causing

deficiencies and malnutrition, hence a high vulnerability to infections, particularly acute pyelonephritis [7] [8]. The male predominance in this work noticed from the recruitment of febrile children, seems to be due to the fact that mothers bring their boys more often to the consultation than their daughters. From infancy to school age, boys are the most affected in our series, whereas in adolescence, it's mostly girls.

From the analysis of **Table 1**, it appears that children with APN come from families whose parents are mostly uneducated with limited purchasing power. These can be decisive in the management (knowledge of the risk factors of a urinary infection, self-medication with antibiotics, diagnostic or even therapeutic delay).

The biological characteristics of children are identical to those described in the literature [9].

On the biological and bacteriological level:

This study revealed a 29% incidence of APN during fever states in children at Gabriel Touré Teaching Hospital in Bamako.

Enterobacteriaceae dominated the bacteriological profile of APNs including *Escherichia coli* (63.9%), the majority species, also reported by several sub-regional and international studies [7]-[13]. This confirms the place occupied by *Escherichia coli* in urinary tract infections in children. The upward pathophysiology of UI as well as the strong colonization of the perineum by digestive enterobacteria and in particular *Escherichia coli*, associated with specific factors of uropathogenicity such as *P. fimbriae* bacterial adhesins explain this predominance [5] [14].

In our series, the second most common bacterium was *E. faecalis* (30.5%). In this work, we have noted the absence of *Proteus mirabilis* and *Staphylococcus epidermidis*, germs found out in APNs in Caen and Vietnam [5] [15].

The study of antibiotic susceptibility of *Escherichia coli* strains in our series has shown significant resistance rates to the usual antibiotics tested. Our rates are almost similar to those observed in Vietnam but very different from those of Caen including resistance to ceftriaxone, gentamicin and cefotaxime which was all less than 5% [5] [16].

The low proportion of strains sensitive to the combination amoxicillin-clavulanic acid and sulfamethoxazole-trimethoprim, ceftriaxone, cefotaxime, is the consequence of the pressure of selection due to the massive prescription and the mostly overuse of these antibiotics, as well as cross-transmission of acquired resistance to plasmid determinism [17] [18]. Regarding aminoglycoside antibiotics, amikacin maintains a good position as opposed to gentamicin. The high rate of resistance to ceftriaxone, cefotaxime and gentamicin compromises the use of these probabilistic antibiotics, widely used in the first-line treatment of APN in children. Fluoroquinolones which have a very interesting antibacterial activity are obviously to be proscribed in the child until the end of the growth period, because of joint toxicity, except in case of resistance to other antibiotics where their use remains possible in the big child from 12 years old.

Lethal risk factors include severe malnutrition, severe dehydration and multi-

focal infection occurring on the ground (trisomy 21, congenital heart disease). *Escherichia coli* and *Enterococcus faecalis* were each encountered in 50% of the deceased children.

The results of first-line antibiotic therapy and antibiogram are grouped in **Table 3** and **Table 4**.

Phenotypic analysis in our series has also revealed strains of ESBL *E. coli* (extended-spectrum beta-lactamases). We know that frequent and inappropriate use of antibiotics is a risk factor for the carriage of ESBL-producing bacteria [19]. Like a local study conducted in 2017 on early neonatal bacterial infection in the neonatal unit of the teaching hospital Gabriel Toure of Bamako, where resistance to cephalosporin of 3rd generation and gentamicin was spectacular (from 12.5% to 100%), combined with our results, there is a worrying multi-resistant local ecology in children (from newborn to 15 years old) in both community and

Table 3. Sensitivity of germs on all antibiograms.

Antibiotic sensitivity tested	Total number of anti-biogram performed	Overall germs		Bacillus Gram Negative Enterobacteriaceae (66.7%)				Cocci Gram Positive Enterococcus type (33.3%)			
				<i>E. coli</i> (63.9%)		<i>K. pneumoniae</i> (2.8%)		<i>E. faecalis</i> (30.5%)		<i>E. faecium</i> (2.8%)	
		S (%)	R (%)	S (%)	R (%)	S (%)	R (%)	S (%)	R (%)	S (%)	R (%)
Penicillin	24	71.1	28.9	80	20	NT	NT	33.3	66.7	100	00
Linezolid	31	100	00	100	00	NT	NT	100	00	100	00
Ampicillin	64	27.3	72.7	45.5	54.5	NT	NT	36.4	63.6	00	100
Ceftriaxone	36	26.9	73.1	26.1	73.9	00	100	81.8	18.2	00	100
Cefotaxime	34	31.4	68.6	47.8	52.2	00	100	77.8	22.2	00	100
Amoxicillin-clavulanic acid	36	04.4	95.6	17.4	82.6	00	100	00	100	00	100
Gentamicin	35	82.1	17.9	82.6	17.4	100	00	63.6	36.4	NT	NT
Amikacin	34	97.6	2.4	90.5	09.5	100	00	100	00	100	00
Tigecilline	35	100	00	100	00	100	00	100	00	100	00
Ciprofloxacin	36	100	00	100	00	100	00	100	00	100	00
Imipenem	35	100	00	100	00	100	00	100	00	100	00
Ertapenem	33	100	00	100	00	100	00	100	00	100	00
Tobramycin	21	100	00	100	00	NT	NT	100	00	100	00
Streptomycin	21	100	00	100	00	100	00	100	00	100	00
Cotrimoxazole	33	13.2	86.8	17.4	82.6	NT	NT	22.2	77.8	00	100
Ticarcillin	25	100	00	100	00	100	00	100	00	100	00
Quinupristin	6	100	00	100	00	NT	NT	NT	NT	100	00

NB: *E. coli*: *Escherichia coli*, *K. pneumoniae*: *Klebsiella pneumoniae*, *E. faecalis*: *Enterococcus faecalis*, *E. faecium*: *Enterococcus faecium*. S: sensitivity; R: Resistance; NT: Not tested.

Table 4. The main bacteria isolated during pyelonephritis in infants and children in Caen (France), Vietnam and Bamako (Mali).

Germ (frequency in %)	Our study	A. Flammang <i>et al.</i> , 2014 [15]	HP Duong <i>et al.</i> 2015 [16]
<i>E. coli</i>	63.9	80.3	80
<i>E. faecalis</i>	30.5	05.6	02
<i>K pneumoniae</i>	02.8	02.6	06
<i>E. faecium</i>	02.8	00	00
<i>Proteus mirabilis</i>	00	01.7	01
<i>Enterobacter cloacae complex</i>	00	01.3	00
<i>Staphylococcus epidermidis</i>	00	01.3	01

Bamako hospitals. Faced with this, the rules of “good use” and “less use” of antibiotics must be adopted by all health professionals.

5. Conclusion

This work has demonstrated the worrying nature of the antibiotic resistance of uropathogenic germs in Bamako. This imposes surveillance of its resistance as well as a rational prescription of antibiotics and with amikacin as probabilistic antibiotherapy of the first intention in our context.

Acknowledgements

This study was submitted to the approval of CNESS (National Committee of Ethics of Health Sciences) of Mali before the start of activities. The consent and informed consent of the parents or guardian have been obtained. All information obtained was kept confidential and the study documents were stored in a key cabinet to which only the investigators and study coordinators had access under the responsibility of the principal investigator. We, the authors, declare having no conflicts of interest in relation to this article.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] National Institute for Health and Clinical Excellence (2018) Fever in Children Younger than 5 Years. <https://www.nice.org.uk/nicemedia/pdf/>
- [2] Crocetti, M., Moghbeli, N. and Serwint, J. (2000) Fever Phobia Revisited: Have Parental Misconceptions about Fever Changed in 20 Years? *Pediatrics*, **107**, 1241-1246. <https://doi.org/10.1542/peds.107.6.1241>
- [3] Gras-Le Guen, C., Levieux, K., Vrignaud, B. and Launay, E. (2018) Acute Infant Fever, Chapter 8 in Pediatric Emergencies. Elsevier Masson, New York.

- [4] DREES (2007) The Care of Children in General Medicine, a Typology of Consultations and Visits. *Studies and Results*, 588.
- [5] Flammang, A., Morello, R., Vergnaud, M., Brouard, M. and Eckart, P. (2017) Study of the Profile of Bacterial Resistance in Pyelonephritis of the Child in 2014. *Archives de Pédiatrie*, **24**, 215-224. <https://doi.org/10.1016/j.arcped.2016.12.006>
- [6] CASFM/EUCAST (2017) French Society of Microbiology. <https://www.casfm.org/annual-conference/2017>
- [7] Garraffo, A., Marguet, C., Checoury, A., Boyer, S., Gardrat, A., Houivet, E., *et al.* (2014) Urinary Tract Infections in Hospital Pediatrics: Many Previous Antibiotherapy and Antibiotics Resistance, including Fluoroquinolones. *Médecine et Maladies Infectieuses*, **44**, 63-68. <https://doi.org/10.1016/j.medmal.2013.12.002>
- [8] Bouskraoui, M., Ait Sab, I., Draiss, G., Bourrouss, M. and Sbihi, M. (2010) Epidemiology of Urinary Infection in Children in Marrakech. *Archives de Pédiatrie*, **17**, 177-178. [https://doi.org/10.1016/S0929-693X\(10\)70921-0](https://doi.org/10.1016/S0929-693X(10)70921-0)
- [9] Lacobelli, S., Bonsante, F. and Guignard, J.P. (2009) Urinary Tract Infections in Pediatrics. *Archives de Pédiatrie*, **16**, 1073-1079. <https://doi.org/10.1016/j.arcped.2009.03.001>
- [10] Anoukoum, T., Agbodjan-Djossou, O. and Arakouma, Y.D. (2001) Epidemiological and Etiological Aspects of Urinary Tract Infection in Children in the Pediatric Department of the University Hospital of Lome (Togo). *Annales d'Urologie*, **35**, 178-184. [https://doi.org/10.1016/S0003-4401\(01\)00024-9](https://doi.org/10.1016/S0003-4401(01)00024-9)
- [11] Marzouk, M., Ferjani, A., Haj Ali, M. and Boukadida, J. (2015) Profile and Antibiotic Sensitivity of 1879 Pathogenic Urinary Tract Bacteria Isolated in Children (2012-2013). *Pediatrics Archives*, **22**, 505-509. <https://doi.org/10.1016/j.arcped.2015.02.015>
- [12] Hanna Wakim, R.H., Soha, G.T. and Mona, W.E.H. (2015) Epidemiology and Characteristics of Urinary Tract Infections in Children and Adolescents. *Frontiers in Cellular and Infection Microbiology*, **5**, 45. <https://doi.org/10.3389/fcimb.2015.00045>
- [13] Khursheed, A.W., Mohd, A., Javaid, A.B., Nazir, A.P., Lubna, S. and Sartaj, A.B. (2016) Pediatric Urinary Tract Infection: A Hospital Based Experience. *Journal of Clinical and Diagnostic Research*, **10**, SC04-SC07.
- [14] Alvarez, C., Pangon, B., Allouch, P.Y. and Ghnassia, J.C. (1992) Urinary Infections: Main Epidemiological, Bacteriological and Clinical Aspects. *Biology Sheets*, **33**, 15-24.
- [15] Larabi, K., Masmoudi, A. and Fendri, C. (2003) Bacteriological Study and Resistance Phenotypes of Germs Responsible for Urinary Tract Infections in a University Hospital Center in Tunis: About 1930 Cases. *Médecine et Maladies Infectieuses*, **33**, 348-352. [https://doi.org/10.1016/S0399-077X\(03\)00180-X](https://doi.org/10.1016/S0399-077X(03)00180-X)
- [16] Duong, H.P., Mong Hiep, T.T., Hoang Janssen, F., Lepage, P., De Mol, P., *et al.* (2015) Management of Febrile Urinary Tract Infections in Vietnamese Children. *Pediatrics Archives*, **22**, 848-852. <https://doi.org/10.1016/j.arcped.2015.05.010>
- [17] Haller, M., Brandis, M. and Berner, R. (2004) Antibiotic Resistance of Urinary Tract Pathogens and Rationale for Empirical Intravenous Therapy. *Pediatric Nephrology*, **19**, 982-986. <https://doi.org/10.1007/s00467-004-1528-7>
- [18] Launay, E., Bingen, E., Cohen, R. and the Pediatric Infectious Pathology Group (2012) Therapeutic Strategies in Urinary Tract Infections of Infants and Children. *Archives de Pédiatrie*, **19**, 109-116. [https://doi.org/10.1016/S0929-693X\(12\)71283-6](https://doi.org/10.1016/S0929-693X(12)71283-6)

- [19] Colodner, R., Rock, W., Chazan, B., Keller, N., Guy, N., Sakran, W., *et al.* (2004) Risk Factors for the Development of Extended-Spectrum Beta-Lactamase-Producing Bacteria in Non-Hospitalized Patients. *European Journal of Clinical Microbiology and Infectious Diseases*, **23**, 163-167. <https://doi.org/10.1007/s10096-003-1084-2>

Abbreviations

APN: Acute Pyelonephritis

UFC: Unit Forming Colony

L: Liter

CBUE: Cyto-Bacteriological Urine Examination

UTS: Urinary Test Strip

CRP: C Reactive Protein

SPSS: Statistical Package for Social Sciences

CA-FSM: Committee of the Antibiogram of the French Society of Microbiology

ESBL: Extended-Spectrum Beta-Lactamases

An Investigation Sheet

File No/_____/phone No/_____/

Date of inclusion in the study/D____//M____//2019/

1. GENERAL CHARACTERISTICS OF THE CHILD

1) Name: First name (s):

2) Age: Date of birth/...../.....

3) Gender: /____/1 = male 2 = female

4) Status of the child/____/

1 = new patient 2 = Already followed for

5) Rank in siblings/____/ (ex; 4th/6)

6) Provenance: /____/

1 = House 2 = Referred (to be specified

2. FAMILY HISTORY

Dad

7) Age of father/____/ (in years)

8) Father's education level: /____/

1 = Out of school 2 = Elementary 3 = Secondary 4 = Tertiary

5 = Koranic school 6 = Not specified

9) Father's profession: /____/

1 = Trader 2 = Civil servant 3 = Worker 4 = Farmer 5 = Pupil/student 6 = unemployed 7 = other (to be specified)

Mother

10) Age of mother/____/ (in years)

11) Mother's level of education: /____/

1 = Out of school 2 = Elementary 3 = Secondary 4 = Tertiary

5 = Koranic school 6 = Not specified

12) Mother's profession: /____/

1 = Housewife 2 = Shopkeeper 3 = Civil servant 4 = Pupil/student 5 = other (to be specified)

3. CLINICAL FEATURES

1) Temperature/____ °C,

2) Time for onset of fever: /____/

1 ≤ 48H 2 ≥ 48H

3) Previous treatment received/____/

1 = none 2 = antipyretic 3 = antibiotic 4 = anti-malarial

Antipyretic 1 dose period

Antipyretic 2 dose period

Antibiotic 1 dose period

Antibiotic 2 dose period

Antimalarial 1 dose period

- 4) Weight (kg)/_____/Size (cm)/_____/arterial pressure (mmHg)/_____/
- 5) Macroscopic appearance of urine/____/
1 = clear 2 = cloudy 3 = purulent 4 = other (.....)
- 6) Urine strip/____/
1 = Positive leukocytes/_____/nitrites/_____/urine density/____/
Other stigmata of the UI at the BU
2 = negative
- 7) Low back pain: yes no
- 8) Lumbar contact: yes no
- 9) Chills: yes no
- 10) Sepsis severe: yes no
- 11) Impairment of the general condition: yes no
- 12) Anorexia: yes no
- 13) Jaundice: yes no
- 14) Polyuria: yes no
- 15) Oliguria yes no
- 16) Digestive problems: yes no
- 17) Dehydration: yes no
- 18) Total fever duration (days): ...
- 19) Favoring factors: yes no If yes, type: ...
- 20) In boys, phimosis: yes no , circumcision: yes no
- 21) History of uropathy: yes no If yes, type: ...
- 22) First episode of acute pyelonephritis: yes no
- 23) Oral hygiene/____/
1 = good 2 = bad (number of decayed teeth

4. PARACLINICAL CHARACTERISTICS

urine

- 1) Method of urine sampling: pocket per-voiding catheterization
CBEU
- 2) Leukocyturia account:
- 3) Other cells:
- 4) Germ on direct examination type: BGN CGP
- 5) Crops
Account:
Name of bacteria:
- 6) Antibiogram yes no
- 7) Sensitive Intermediate Resistance
1.....1..... 1
2..2..... 2
3.....3..... 3
4.....4..... 4
5..5..... 5

Biology

Inflammation markers

8) CRP: yes no value (mg/l): ...9) pct: yes no value ($\mu\text{g/l}$): ...

Complete blood count

10) Leukocytes ($/\text{mm}^3$): Neutrophils ($/\text{mm}^3$)Monocytes ($/\text{mm}^3$)

11) Hemoglobin (g/dl):

12) pads (giga):

Biochemistry and blood cultures

13) Creatinine: yes no value ($\mu\text{mol/l}$): ...14) Blood icon: yes no if yes normal abnormal 15) Blood cultures: yes no if yes, negative positive

(specify the germ

16) Antibigram yes no

Sensitive Intermediate Resistance

1..... 1..... 1.....

2..... 2..... 2.....

3..... 3..... 3.....

4..... 4..... 4.....

5..... 5..... 5.....

17) Thick drop negative positive

18) Other biological examinations

Imaging yes no 19) Renal and urinary tract ultrasound: yes no 20) If yes injuries: yes no type:21) CT scan of the kidneys and urinary tract: yes no

5. RETAINED DIAGNOSIS/____/

1) = PNA 2 = others (to be specified)

6. TREATMENT

1) Prescriber/____/

1 = PhD students 2 = doctors in specialization = Pediatricians 4 = others (to be specified)

2) Total duration of antibiotic therapy (days):

3) Hospitalization: yes no length of hospitalization (days): ...4) Outpatient treatment: yes no

Parenteral treatment

5) Parenteral ATB duration (days):

6) Ceftriaxone: yes no dose (mg/kg/day):/...../.....7) Cefotaxime: yes no dose (mg/kg/day):/...../.....

8) other antibiotics: type: dose (mg/kg/day):

9) Gentamicin: yes no dose (mg/kg/day):/...../.....

10) Compliant antibiotics: yes no

Other parenteral drugs

11) antipyretic yes no (molecules and doses to be specified)

antipyrétique1doseperiod

antipyrétique2doseperiod

12) anti-malarial yes no (molecule and dose to be specified)

antimalarialdoseperiod

13) other drugs yes no (molecules and doses to be specified)

molecule 1 dose (mg/kg) duration

molecule 2 dose (mg/kg) duration

molecule 3 dose (mg/kg) duration

molecule 4 dose (mg/kg) duration

14) Other compliant parenteral drugs: yes no

Oral treatment

15) Antibiotic (ATB) oral treatment: yes no

ATB1 dose (mg/kg) duration

ATB2 dose (mg/kg) duration

16) Oral ATB duration (days):

17) Other oral treatments: yes no

molecule1.....dose (mg/kg).....duration.....

molecule2.....dose (mg/kg).....duration.....

molecule3.....dose (mg/kg)duration.....

18) Compliant oral treatment: yes no

19) Other types of processing

treatment 1..... dose (mg/kg)..... duration.....

treatment 2..... dose (mg/kg)..... duration.....

treatment 3..... dose (mg/kg)..... duration.....

6. EVOLUTION

Immediate complications

1) abscess: yes no

2) renal failure: yes no

3) High blood pressure: yes no

Exit

1. Exit procedure/____/

1 = healed 2 = lost to follow-up 3 = deceased

2. Release date/____//____//2019/

4. Exit diagnosis/_____