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ORIGINAL ARTICLE

Assesment of Antimicrobial Resistance Modes in Children with Pyelonephritis

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KEYWORDS

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ABSTRACT: Pyelonephritis is a common pediatric infection with high risk of renal injury in children less than 5 years. Prompt diagnosis and treatment is mandatory to minimize the risk of renal scarring. To investigate the causative pathogen of pediatric pyelonephritis and to assess antibiotic resistance among these patients. The study conducted from the 1st of April 2019 to the 30th of December 2019 at Al-Diwaniya maternity and children teaching hospital and at outpatient clinic. Total number of patients involved was 130 children. We classified them in to two groups. Group 1(3 months -12 months) while Group 2 were (1-5 years old). Total number of patients involved in this study was 130 patients. 54 of them were (3-12 months) termed as group 1 and 76 of them (1-5 years) were group 2. From 130 urine samples, we get 186 bacterial isolate, majority was with one bacterial isolate (67.1%), multiple bacterial isolate also seen but in less number (32.9%). Regarding the causative bacterial pathogen. E. coli was the commonest microorganism isolated (73.07%), then Proteus mirabilis (16.92%), enterococcus (6.15%) and staphylococcus aureus (3.84%). On evaluating antibiotic sensitivity, we found that Imipenem, Nalidxic acid, Nitrofurantoin and Ciprofloxacin are highly sensitive antibiotics in vitro. Gentamycin show less sensitivity than amikacin. Cephalosporin, Penicillin and Trimethoprim-sulfamethoxazole show no valuable sensitivity (very high resistance).

INTRODUCTION

Acute pyelonephritis is an upper urinary tract infection that usually occurs secondary to ascending infection from the lower tract [1].

It's the commonest bacterial infection in children especially in presence of certain risk factors. A1 Urinary tract anomalies are associated with increased risk of pyelonephritis like vesicoureteric reflux [2].

Its incidence is very high among febrile infants especially in circumcised male. There is a high rate of recurrence which can result in renal damage [3]. The seriousness of the condition can have led to over-diagnosis with unnecessary antibiotic use [4].

In infancy, there are many difficulties in the diagnosis of pyelonephritis as they usually presented with non-specific symptoms which may cause delay in diagnosis and carry more risk of renal damage [5].

Recently, antimicrobial resistance is a serious problem which occurs due to improper, careless and overuse of them in particular for those patients presented with recurrent symptoms or recurrent infection [6].

This study was performed aimed to investigate the causative pathogen of pediatric pyelonephritis (3months-5 years old) and to assess antibiotic resistance among these patients.

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MATERIALS AND METHODS

The study was conducted from the 1st of April 2019 to the 30th of December 2019 at Al- Diwaniya maternity and children teaching hospital and at outpatient clinic where they seek medical advice for their symptoms.

Oral consents were taken from all families.

Total number of patients involved was 130 children. We classified them in to two groups. Group 1(3months-12 months) while Group 2 (1-5 years old).

Information obtained from those patients regarding age, gender, their chief complain, severity and duration of their symptoms. Physical examinations also were done, investigations in the form of urinalysis and urine culture. We obtain urine sample by sterile collection bag for younger age group and mid-stream urine sampling for older cooperative patients.

Exclusion criteria involve all children who had another infection and those with recent antibiotic use.

Urinalysis done including the biochemical dipstick test and microscopic examination. We ensured proper sterile sampling collection and proper storage to be kept fresh for examination.

Urine culture was also performed. The following criteria were dependent for diagnosis;

>10^5 CFU/ML of single pathogen or 10^4-10^5 CFU/ML of single pathogen with symptoms.

Hence we consider pyelonephritis when patients had symptoms + abnormal urinalysis+ positive urine culture.

RESULTS AND DISCUSSION

Total number of patients involved in this study was 130 patients. 54 of them were (3-12 months) termed as group 1 and 76 of them (1-5 years) were group 2. The patient's characteristics were shown in Table 1.

Table 1. The patient's characteristics

Characteristics		**Group 1**	**Group2**
Age group		**3 months-12 months**	**1 year-5 years**
Number	Total 130	54	76
M:F ratio	Number (%)	41-13(4:1)	8:68(1:9)
Clinical presentation	High fever	20(37%)	15(19.7%)
	Repeated vomiting	12(22.2%)	8(10.5%)
	Offensive urine	7(12.9%)	8(10.5%)
	Irritability	10(18.5%)	0
	Loin pain	0	20(26.3%)
	Dysuria/Crying during micturition	5(9.2%)	25(32.8%)
Toxicity		5(9.2%)	3(3.9%)
Time of presentation	<3 days	18(33.3%)	17(22.2%)
	> 3 days	36(66.6%)	59(77.6%)

From 130 urine samples, we get 186 bacterial isolate, majority was with one bacterial isolate (67.1%), multiple bacterial isolate also seen but in less number (32.9%). This was different between the two groups (Table 2).

Regarding the causative bacterial pathogen. E. coli was the commonest microorganism isolated (73.07%), then Proteus mirabilis (16.92%), enterococcus (6.15%) and staphylococcus aureus (3.84%), as shown in Table 3.

On evaluating antibiotic sensitivity, we found that Imipenem, Nalidxic acid, Nitrofurantoin and Ciprofluxacin are highly sensitive antibiotics *in vitro*.

Gentamycin show less sensitivity than amikacin. Cephalosporin, Penicillin and Trimethoprim-sulfamethoxazole show no valuable sensitivity (very high resistance).

Urine culture for antibiotics resistance and sensitivity were reported among our patients in Table 4.

Table 2. difference of bacterial isolates between the two groups.

Group	only one bacterial type isolate	multiple bacterial isolate	p-value
1	80%	30%	0.001*
2	20%	70%	

p-value is significant <0.05

Table 3. The causative pathogen detected.

Microorganism	Percent
E.coli	73.07%
Proteus mirabilis	16.92%
Enterococcus	6.15%
Staph aureus	3.84%

Table 4. Antibiotics Resistance among Children with Pyelonephritis

Antibiotics	Group1		Group 2		Total		p-value
	n=54	%	n=76	%	n=130	%	
TMP-SMX	68	36.50%	52	28%	120	64.50%	>0.05
Amoxicillin	64	34.40%	52	28%	116	62.40%	>0.05
Ceftazidime	62	33.30%	42	22.60%	104	55.90%	>0.05
Ceftriaxone	64	34.40%	50	26.90%	114	61.30%	>0.05
Cefotaxime	48	25.80%	38	20.40%	86	46.20%	>0.05
Amikacin	48	25.80%	38	20.40%	86	46.20%	>0.05
Gentamicin	66	35.50%	40	21.50%	106	57%	0.049*
Ciprofloxacin	30	16.10%	10	5.40%	40	21.50%	>0.05
Nitrofurantoin	28	15.10%	4	2.10%	32	17.20%	0.003*
Nalidixic acid	26	14.10%	2	1.10%	28	15.20%	0.005*
Imipenem	4	2.10%	0	0%	4	2.10%	-

p-value is significant <0.05 *

In this study, we found that male to female ratio among infants was 4:1 with male predominance, which can be explained by physiological phimosis and non circumcises male [7].

This was adverse among group 2 as M: F ratio wasv1:9 which may be related to the anatomical short urethra and proximity of the anus [8].

In infancy the most common presentation was high fever (37%) followed by irritability (27.7%), while the majority of older aged group were presented with offensive odor urine and dysuria (36.8%) followed by loin pain (32.8 %). These are the usual presentations seen among patients with pyelonephritis [8].

9.2% of infants presented to us with toxic manifestation and the hospitalization was required, in comparison only (3.9%) of the second group has toxic symptoms.

The result can be explained by the weakness and immaturity of immune system among infants.

66.6% of patients in group 1 and 77.6% of group 2 were presented after 3 days of symptoms; this is unfortunately common in our society which may be related to the low socioeconomic status and increase social habit of self-medication prior to seeking medical advice.

80% of isolates in group1 show multi-bacterial isolates while only 25% of group 2 showed that. This can be explained by the weak immune system response in infants with risk of ascending and opportunistic infections [1, 9].

E. coli was the predominant bacterial isolated by culture (73.07%), which was also reported by many previous studies [6, 10-14].

The predominance of E. coli may be explained by its high virulence and its ability to escape immune system by forming a biofilm.

The second bacterial isolate was Proteus mirabilis (16.92%) followed by enterococcus (6.15%) and staphylococcus aureus (3.84%). This result was close to that seen in Syria [9].

On assessing antimicrobial sensitivity, we found that imipenem, nalidixic acid, nitrofurantoin and ciprofloxacin are highly sensitive antibiotics in vitro, which was shown also by many other studies [10,16 and 17], but the opposite was seen by others [11,14 and 18].

The high sensitivity of these antibiotics may be related to their limited use by medical prescription only.

Nitrofurantoin is an antibiotics used only in prophylaxis because of its limited renal tissue spread [19, 20].

Gentamycin does not show the same sensitivity to amikacin, which was seen previously by another study also. B Its sensitivity is much lower than many other studies [6, 15, 16 and 20-22] which may be related to the recent overuse.

Cephalosporin (cefotaxime, ceftriaxone and ceftazidime) also don’t show high sensitivity, which was also reported previously by others [6, 9, 16, 17, 21 and 22].

This result may be secondary to development of B-lactamase resistant strain due to their overuse by many nosocomial infections.

Trimethoprim-sulfamethoxazole and penicillin do not show any valuable sensitivity making them in effective in management of such cases. This result was consistent with that seen by others studies [6, 11 and 22].

The emergence of antibiotic resistance following the overuse of penicillin and trimethoprim-sulfamethoxazole without medical prescription in management of any febrile illness or viral gastroenteritis.

The microbial resistance to gentamycin, trimethoprim-sulfamethoxazole and nitrofurantoin were more commonly among the older age group with statistically significant p-value (<0.05), while for other antibiotics there is no statistical significant p-value (>0.05).

CONCLUSIONS

-Pyelonephritis is a common and serious infection in children less than 5 years.

-*E.coli* is considered the commonest pathogen isolated by culture.

-Imipenem, Ciprofloxacin, Nalidixic acid are highly sensitive antimicrobial for pyelonephritis if suitable for the age group.

-As prophylaxis, nitrofurantoin is a good choice.

-Cephalosporin, Penicillin, Trimethoprim-sulfamethoxazole should not be more prescribed for pyelonephritis unless confirmed antibiotic sensitivity by urine culture.

-Increase society education is crucial step in controlling the recent overuse of antibiotics to control the multidrug resistant pathogen emergence.

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Not applicable.

Conflict of interest

The authors declare no conflicts of interest.

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