



# Possible role of C-reactive protein for detection of gram positive urinary tract infections in children.

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## Abstract

Uropathogenic strains of gram positive bacteria from 90 child aging from 1 to 9 year were studied from first February /2008 to end June/2008 for their susceptibility profile .the various isolates were *Staphylococcus aureus* (62), *Streptococcus pneumoniae*(16) and *Bacillus* spp.(12) *S. aureus* was the commonest causative agent for UTI(68.8%).Males were more infected (70%)than females and UTI were more in the children in 4 to 6 years (40%) than other ages groups. Antibiotics susceptibility pattern of these isolates against 28 different antibiotics revealed that Norfloxacin ,Nitrofurantion and Amikacin were effective for treatment of UTI (75-100%). Amoxicillin, Azithromycin, Bacitracin, Nitrofurantion , Carpeniciln, Cefoxitin, Ceftrizoxime, Cephalexin and methicillin were not found to be effective for treatment of UTI (0-20%). The concentration of CRP was found to be more than 24 mg/dL in most patients (74.4%) and this level refers to true bacterial infection while the value of WBC was > 15000 / mm in (86.6%) of patients and ESR was found to be >35mm/h in (85.5%) of patients. In this study we found that CRP concentration were neither completely sensitive nor specific for detecting UTI infection but addition of CRP testing to that of WBC and ESR ensures the detecting of UTI.

## Introduction

Urinary tract infection (UTI) with its diverse clinical syndromes and affected host groups remains one of the most common but widely misunderstood and challenging diseases encountered in children in clinical practice [1]. Approximately 2%-8% of children have urinary tract infection (UTI), depending of the age and gender [2]. Despite the wide spread availability of antibiotics, UTI remains the most common bacterial infection in the human populations [3]. Since patterns of antibiotics resistance in a wide variety of pathogenic organisms may verity even over short periods and depend on site of isolation and on different environments, periodic evaluation of antibacterial activity is needed to update this information [4]. Measurement of C-reactive protein (CRP), an acute phase protein synthesized by hepatocytes, is valuable in distinguishing systemic bacterial infection [5]. Many studies have addressed the value of CRP in detection bacterial urinary tract infection in addition to white blood cell and absolute neutrophil and erythrocyte sedimentation rate (ESR) [4,6, 7]. The present study recorded cases of UTI in children and studied spectrum of gram positive bacterial isolates and their antibiotics susceptibility and investigated the value of CRP in urinary tract infection in compared with WBC and ESR to determined the diagnostic properties of quantitative CRP associated with clinically undetectable serious bacterial infection in children 1-9 years of age.



## Materials and Methods

In this prospective study we studied 90 child (rectal temperature > 38 °C) their ages, ranging from 1-9 years who presented to the pediatric clinic of emergency department of Babylon maternity and children hospital from first May/2008 to end July/ 2008, all children were hospitalized.

Every child underwent a history and physical examination and a full evaluation for sepsis was performed, including total WBC count, ESR, CRP, blood culture, gram stain, urine culture and urine analysis (UA).

Blood and urine specimens were cultured using stander media and techniques.

All urine specimens were obtained by clean container with parent's assistance.

All urine analysis was performed in a certified clinical laboratory.

Specimens were analyzed with both standard UA and haemocytometer WBC counts, the centrifuged urine specimens were examined microscopically on Neubauer chamber by the same technician.

C-reactive protein test done by using latex kit (Humatex CRP ,Germany) for qualitative and semi-quantitative determination.

A loop calibrated to deliver 0.01 ml from Brain heart infusion broth vials inoculated with the urine specimen and after 24 to 48 hour at 37°C and appeared turbid was used to inoculate plate's containing blood agar and nutrient agar.

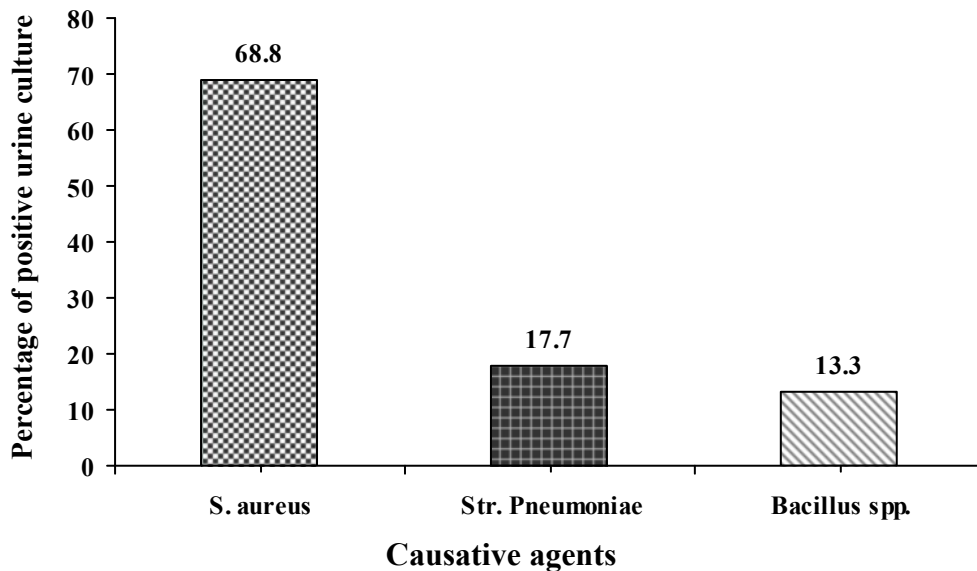
All plates were incubated at 37°C and examined at 24-48 hours for colony count and bacterial identification.

For standard UA, pyuria was defined as at least 5 WBCs/ hfp. For hemocytometer WBC count, pyuria was defined as al least 10 WBCs/ mL In this study we used 28 different antibiotics to estimate the sensitivity of UTI causative agents, using disk diffusion agar using Muller Hinton agar.

Quantitative urine cultures were performed in the microbiology laboratory. [9,10].

## Result and discussion

The study group consisted of 90 children ranging in age from 1-9 years. Amongst the patients more than 68% showed *staphlococcus aureus* as the common isolate while *Streptococcus pneumoniae* and *Bacillus* spp was found in 17.7% and 13.3% of patients respectively (Figure 1). In another study of urine tract infection *S. aureus* was found to be the commonest gram positive isolated organism followed with *Streptococcus* spp. [11]. *Staphylococcus saprophyticus* was found to be 70.1 % from all isolates of UTI in children from kabala.[12].



**Figure 1: Percentage of Etiological agents causes UTI in children**

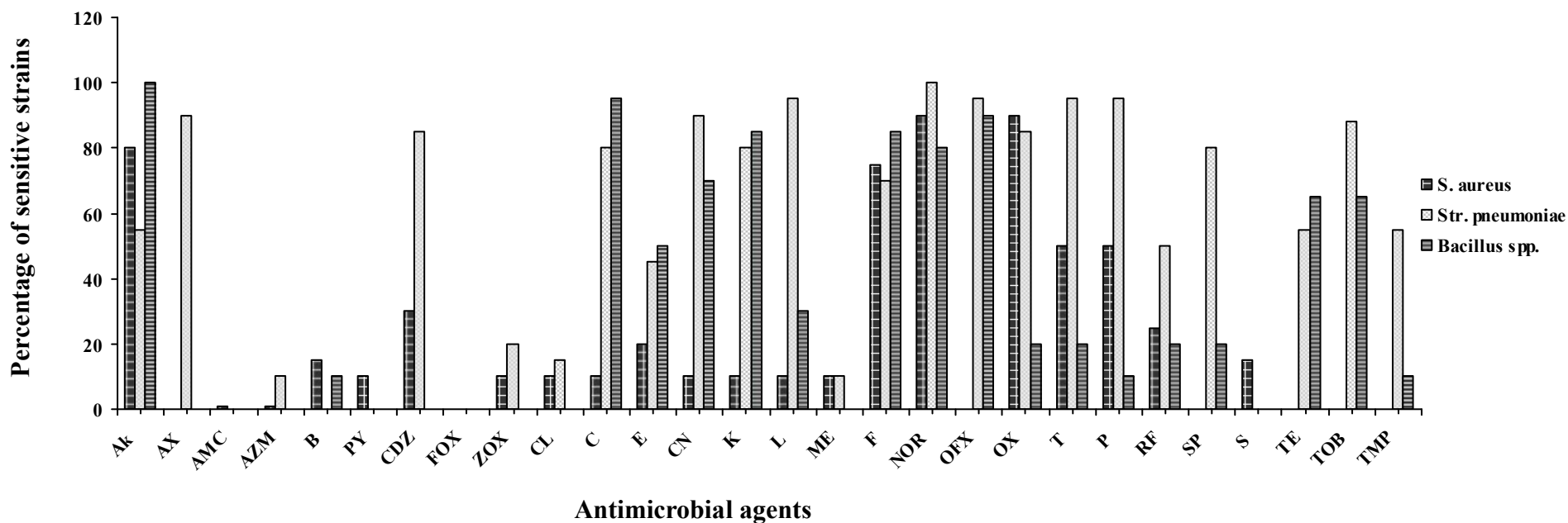
the distribution of UTI causes. UTI were more in children 4- 6 years than in other age groups and was represented 40% of all patients(Table1). Males were more infected (70%) than females and this result agreed with another study [11].While differ from another study which found that males were less infected(13.5%) than females(15.3%) [12]. This study showed significant differences of *S. auerus* with age and gender but showed non significant relation of *St. pneumoniae* and Bacillus spp with age and gender factors ( $P \leq 0.01$ ).



**Table 1: Distribution and frequency of UTI causes isolates according to gender and age.**

Age group (Year)	Gram Positive UTI Causes					
	<i>Staphylococcus aureus</i>		<i>Streptococcus pneumoniae</i>		<i>Bacillus spp.</i>	
	Male	Female	Male	Female	Male	Female
<1	12	2	5	1	2	2
1-3	4	1	3	-	1	-
4-6	22	7	-	4	1	2
7-9	7	7	2	1	4	-
Total	45	17	10	6	8	4
	62(68.8%)		16(17.7%)		12(13.3%)	

Antibiotics susceptibility pattern of study isolates showed that most isolates of *S. aureus* were sensitive against Norfloxacin, Oxacillin and Amikacin, 90%, 90% and 80% respectively. But all isolates of this bacterium were resistance against Amoxicillin, Cefoxitin and Ofloxacin. All *St. pneumoniae* isolates were sensitive against Norfloxacin(100%) but resistance(100%) against Amoxicillin+Clavulanic acid (AMC), Bacitracin, Carpenicillin, Cefoxitin and Streptomycin. *Bacillus spp* isolates were sensitive against Amikacin (100%) Chloromphenicol (95%) and Nitrofurantoin(85%), Kanamycin (85%) but showed different degree of sensitivity toward other antibiotics (Figure 2). Cefoxitin in the present study was found to be no effective for UTI as all the uropathogens showed high degree of resistance to it, and this result agreed with the other study which showed that. Norfloxacin was effective for treatment of UTI and third generation Cephalosporin was not found to be effective for treatment of UTI [4]. In another study Gentamycin was the drug of choice for most of strains causes UTI while high degree of resistance showed against Tetracycline and Norfloxacin [13].



AK \Amikacin, AX \Amoxicillin, AMC \Amoxicillin + Clavulanic acid, AZM \Azithromycin, , B \Bacitracin, PY \Carbencillin, CDZ \Cefodizime, FOX \Cefoxitin, ZOX \Ceftizoxime, CL \Cephalexin, C \Chloromphenicol E \Erythromycin, CN\Gentamycin, K\Kanamycin, L\Lincomycin, ME\Methicillin, F\Nitrofurantoin, NOR\Norfloxacin, OFX \Ofloxacin, OX\Oxacillin, T\Oxytetracyclin, P\Penicillin G. RF \Rifamycin, SP\Spiramycin, S\Streptomycin, TE\Tetracycline, TOB\Tobramycin, TMP\Trimethoprim.

Figure 2: Antimicrobial potency and spectrum for 28 selected antimicrobial agents tested against most frequently occurring UTI pathogens

Figure 3 showed the value of diagnostic test in which the CRP level was more than 24 mg/dL in 67 patients (74.4%) of all patients' studies, and ESR was more than 35 mm/h in 77 patients (85.5%) while WBC was found to be more than 15000/ mL in 78 of patients(86.6) with positive blood culture.

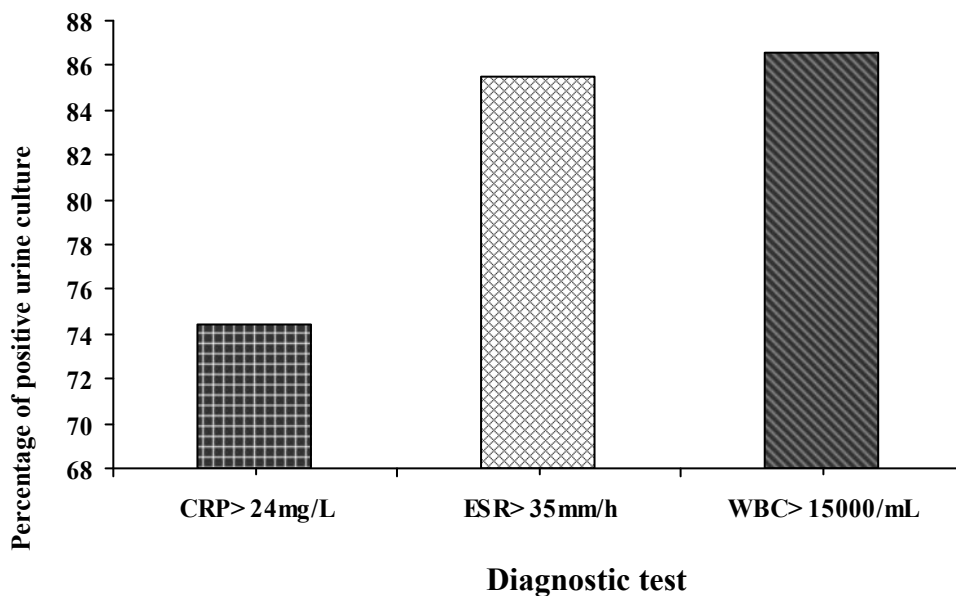


Figure 3: The percentage of diagnostic tests in presence of a positive blood culture

This result in line with another study which found the value of CRP above 85 mg/L for UTI compared with the value of WBC which found more than 15000mm<sup>3</sup>/L [7]. In another study used WBC, ESR and CRP to distinguish a SBI in infant showed that non of these parameters alone commonly used by physicians is a reliable diagnostic tool to rule out SBI in infants with fever without source of infection and according to this study the value of WBC > 15000, ESR > 20 mm/h and CRP = 2 mg/dL [14]. The value of CRP in this study appears to be higher in most children and the other who has low level of CRP may be treated with antibiotic before the study. Because of level of CRP remain elevated with on going inflammation and tissue destruction, but with resolution



they decline rapidly because of relatively short half-life of 4-7 hours [6]. The value of CRP in this study appears to be higher in most children and the other who has low level of CRP may be treated with antibiotic before they were studied and this lead to decreased level of CRP in the sera of patients[15].

In this study the elevation of CRP concentrations is non completely sensitive for detecting infection in patients with UTI, but could be ensured the infection and this result agreed with another study which explained that CRP concentration were neither completely sensitive nor specific for detecting infection in patients with bacteremia. [16].



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## الخلاصة

الدور المحتمل لبروتين إعادة التنشيط-C في التحري عن التهاب المجاري البولية المتسببة بالبكتيريا الموجبة لصبغة غرام عند الاطفال.

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تم دراسة العزلات الموجبة لصبغة غرام والمسببة لالتهاب المجاري البولية عند ٩٠ طفل تراوحت اعمارهم بين ١-٩ سنة للفترة من اول شهر شباط / ٢٠٠٨ الى نهاية حزيران / ٢٠٠٨ وتم دراسة حساسيتها تجاه المضادات الحيوية. تم الحصول على ٦٢ عزلة من بكتيريا *Staphylococcus aureus* و ١٦ عزلة من *Streptococcus pneumoniae* و ١٢ عزلة من *Bacillus spp.* ووجد ان *Staphylococcus aureus* الاكثر شيوعا في احداث التهاب لمجاري البولية وبنسبة 68.8% . ووجد ان الذكور اكثر عرضة للاصابة من الاناث بمعدل 70%. كما اظهرت دراسة حساسية ٢٨ مضاد حيوي تجاه العزلات البكتيرية بان المضادات الحيوية *norfloxacin* و *nitrofurantion* و *amikacin* كانت فعالة في علاج التهاب المجاري البولية وبنسبة ٧٥-١٠٠% وكانت المضادات الحيوية *amoxicillin* و *carpenicillin* و *cefotaxime* و *ceftriaxone* و *methillicin* غير فعالة في علاج التهاب المجاري البولية إذ تتراوح نسبة لحساسية بين ٢٠-٠% . كما وجد ان مستوى بروتين إعادة التنشيط C في امصال 74.4% من المرضى كان اكبر من 24 mg/dL وهذا التركيز يشير الى وجود اصابة بكتيرية في حين ان عدد خلايا الدم البيض كان اكبر من 15000 /mm في 86.6% من المرضى ومعدل ترسيب كريات الدم الحمر اكبر من 35 h/mm في 85.5% من المرضى. وبهذه الدراسة وجد ان اجراء فحص بروتين إعادة التنشيط -C لم يكن حساس او متخصص في تشخيص التهاب المجاري البولية في حين ان اضافة فحص CRP الى فحص WBC و ESR يؤكد وجود اصابة المجاري البولية .