

WHITE BLOOD CELL COUNT, ABSOLUTE NEUTROPHIL COUNT, AS PREDICTORS OF HIDDEN BACTERIAL INFECTIONS IN FEBRILE CHILDREN 1-18 MONTHS OF AGE WITHOUT FOCUS

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ABSTRACT

Objectives: To study the relationship between White Blood Cell (WBC), Absolute Neutrophil Count (ANC) in febrile children 1-18 months of age as predictor of bacterial infection, so as to improve our predictability of bacterial infections in emergency room to decrease unnecessary admissions and antibiotic use.

Methods: Retrospective review was performed on febrile patients 1-18 months of age that were admitted to hospital between August 2002 and March 2003 on the presumptive diagnosis of fever without focus. Complete septic work up was done for all patients according to local hospital protocol including Complete blood count (CBC), blood culture, urine culture, Chest X-Ray (CXR) and lumbar puncture. Patients who had history of antibiotics use within 48 hours of admission were excluded from the study. History, physical examination, laboratory and radiology data were reviewed. Data about the age, sex, temperature, presence or absence of focal bacterial infection, WBC, ANC, CXR report & body fluid culture results were collected & analyzed.

Results: Thirty-four patients were reviewed in this study. Eight patients (23.5%) had bacterial infection: classified as group 1 (2 patchy pneumonia, 3 Urinary tract infection (UTI), 2 meningitis, 1 Occult bacteremia (OB) and 26 patients (76.5%) had no evidence of bacterial infection, classified as group 2. No significant difference was found between the two groups in respect to age, sex, temperature and WBC $P > 0.05$, while there was a significant difference between the two groups in respect to the ANC $P = 0.02$, also ANC had better sensitivity (78%) and specificity (89%) than WBC (sensitivity 77%, specificity 62%).

Conclusion: ANC is a good predictive test for determining bacterial infection in young febrile children without focus. However there is need for other more reliable rapid cost effective measures in dealing with young febrile children at emergency department.

Abbreviations: OB=Occult bacteremia, UTI=Urinary tract infection, CBC=Complete blood count, WBC=White blood cell, ANC=Absolute neutrophil count, CRP=C-reactive protein, CXR=Chest X ray, CSF=Cerebrospinal fluid, LP=Lumbar puncture

KEY WORDS: WBC count, Neutrophil count, Bacterial infections, Febrile children

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INTRODUCTION

Fever is one of the most common symptoms faced by pediatrician and emergency physician. The clinical and laboratory approach to diagnosis and managing febrile illness in infants and toddlers remains challenging¹.

Approximately 20% of these children will have no identifiable source of fever after history and physical examination. Although most

of these children will have a benign viral illness, children < 3 years of age are at increased risk of clinically undetectable bacterial infections^{2,3}. Approximately 2% to 3% of these children have OB⁴, while 2% to 8% have UTI⁵. Other causes include bacterial pneumonia, meningitis etc.

Although antibiotics treatment is necessary for children with bacterial infection, it is also important to limit therapy to those children at greatest risk. Because the majority of febrile young children do not have bacterial infection; laboratory test and expected antibiotic therapy of these children adds to cost, time, discomfort and parental anxiety and may contribute to antibiotic resistance.

Practice guidelines that were developed to aid clinicians in the management of the febrile child have suggested the use of WBC as a discrimination between febrile patients who could be otherwise observed without prophylactic antibiotics therapy and those who merit treatment⁶.

In this study comparison has been done between WBC with ANC as predictors of bacterial infection in young febrile children 1-18 months of age.

PATIENTS AND METHODS

A retrospective review was performed on all febrile patients 1-18 months of age that had been admitted to hospital as a case of fever without a focus between August 2002 and March 2003. The study was done in Queen Alia Hospital; which is one of six-second care general hospitals of the Royal Medical Services in Jordan, situated in the capital; Amman.

The hospital offers general pediatric care (in conjunction of other medical branches) to the citizens of eastern Amman, through general out patient clinics, emergency services and general pediatric ward with a capacity of 27 beds, two intensive care beds and separate neonatal unit (8 beds), attached directly to King Hussein Medical Center as a referral hospital with tertiary care facilities.

According to management guidelines

followed in the hospital, all febrile children 1-18 months of age with fever 39°C without a focus should be admitted to hospital, during which complete septic work up should be done including CBC, ANC, CXR, blood and appropriate urine culture and lumbar puncture with Cerebrospinal Fluid (CSF) culture and empiric antibiotic therapy started till definite culture results received.

Patient excluded from the study were those with acute otitis media, acute pharyngitis, clinical pneumonia, acute respiratory tract infection, acute gastroenteritis and those with history of antibiotic use during the past 48 hours of admission, those with known immunodeficiency state or those who received vaccination during the previous two days.

Medical records were reviewed on eligible patients, data abstracted on each patient included: age in months, presenting temperature in degree centigrade, weight in kilograms, the presence or absence of focal bacterial infection, the WBC, ANC, CXR report, and blood, urine, CSF culture results.

RESULTS

Thirty-four patients met the criteria's for this study and their medical records were reviewed. Eight patients (23.5%) had bacterial infections and categorized as group 1, 26 patients (76.5%) had no evidence of bacterial infection and categorized as group 2.

The 8 patients who had bacterial infections: 2 of them had patchy pneumonia documented by CXR, 3 with UTI and Escherichia Coli was the causative agent in all, 2 with meningitis and Streptococcus Pneumonia was the causative agent and one patient with Streptococcus Pneumonia bacteremia. Comparison of age, sex, temperature, WBC and ANC between the two groups is shown in Table-I.

This study showed no significant difference between the two groups in respect to the age, sex, temperature and WBC; $P > 0.05$, while the only significant difference was found in the ANC results $P = 0.02$

The sensitivity and specificity of both WBC

TABLE-I

	<i>Patients with bacterial infections</i> No: 8 (23.5 %)	<i>Patients without bacterial infections</i> No: 26 (76.5 %)	<i>P-Value</i>
Age (month)	8.5	7.6	0.52
Sex (% male)	30.5	49.6	0.18
Temperature(°C)	39.3	39.2	0.87
WBC 1000/mm ³	17.7	13.2	0.07
ANC 1000/mm ³	13.2	7.6	0.02

* Values shown as means unless other wise noted

TABLE-II

	<i>Cutoff point</i>	<i>Sensitivity</i>	<i>Specificity</i>
WBC 1000/mm ³	15000	77%	62%
ANC 1000/mm ³	10000	78%	89%

and ANC in predicting bacterial infection is shown in Table-II, which were studied on a cutoff point of 15,000 cells/mm³ WBC and 10,000 cells/mm³ ANC (according to general guidelines)⁶. As shown in table-II, the sensitivity (78%) and specificity (89%) of ANC were better than that for WBC (sensitivity 77%, specificity 62%).

DISCUSSION

Total white blood cell count is the most commonly used screening test for occult bacteremia, and clinical practice guidelines suggested that using a total WBC of ≥ 15000 as a determining factor between patients who can be observed and those who need antibiotic therapy⁶. However because of its low predictive value, empiric treatment based on a WBC $\geq 15,000$ result in unnecessary treatment in 85%-95% of cases^{4,6}.

The management of febrile young children without apparent source of infection remains controversial, because there has been no test available with adequate sensitivity and specificity required to distinguish which child are

at high risk for bacterial infection.

Total WBC is the most commonly used laboratory test used in this clinical situation. As screening test for OB, a total WBC ≥ 15000 cells/mm³ has a sensitivity of 80% and specificity of 69%⁷. Although 80% of children with OB will have a WBC ≥ 15000 , 94% of children with a WBC ≥ 15000 will not have OB. Some studies suggested that acute phase reactant; such as CRP may be helpful in this clinical situation⁸⁻¹⁰.

This study indicates that the use of ANC is better than the use of WBC alone, with better sensitivity and specificity. A study by Kupperman et al. had almost similar results. His data, based on 164 cases of occult pneumococcal bacteremia occurring in 6579 patients, suggested that ANC values of ≥ 10000 was a better discriminator for bacteremia than WBC of 15000 cells/mm³.⁷

CONCLUSION AND RECOMMENDATIONS

ANC is a good predictive test for determining bacterial infection in young febrile young

children. There is a need to do it on larger study population and to extend the age of patients up to the age of 3 years for a more convenience results. The relationship between ANC, WBC and other rapid detection test like acute phase reactant; C-reactive protein, erythrocyte sedimentation rate, should be studied.

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