ORIGINAL ARTICLE

Usefulness of gender and abnormal blood count for predicting pneumonia outcome in children

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Abstract *Background:* Pneumonia is still a leading cause of death among children in developing countries.

The aim of the study is to identify some risk factors for poor pneumonia outcome. The studied factors were: male sex, thrombocytosis, thrombocytopaenia, leucocytosis, leucopaenia and anaemia.

Patients and methods: A prospective cross sectional study included 242 children with community acquired pneumonia (CAP) who were attending a tertiary care hospital. Work for the study started at October 2012 and ended at August 2014. Medical history, physical examination, complete blood count (CBC) and C-reactive protein were done for all patients.

Results: 27.3% of the patients developed pulmonary complications, 17.4% acquired sepsis while death occurred in 3.7% of cases. Multinomial logistic regression was used to detect the independent effect of each studied factor. Thrombocytosis, anaemia and age ⩽2 years were associated with the development of pulmonary complications. Thrombocytopaenia and leucopaenia were associated with the fatal course of the disease. Male sex was a protective factor against pulmonary complications; however it was a risk factor for acquiring sepsis. Leucocytosis did not affect the prognosis of CAP.

Conclusion: Sex of the patient and data from complete blood count are very useful for the prediction of pneumonia outcome. Anaemia, thrombocytosis, thrombocytopaenia, and leucopaenia are considered as predictors of bad prognosis. Females are more vulnerable to pulmonary complications while maleness is associated with sepsis and determination of these indicators highlights suspicion of pneumonia prognosis and allows application of early appropriate interventions.

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Introduction

Although there is an overall reduction in pneumonia mortality, it is still a leading cause of death among children especially in developing countries. In Africa, pneumonia related deaths account for 14% of total deaths in children (17% if

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including the neonatal pneumonia cases) [1]. Sepsis and pulmonary complications of pneumonia as pleural effusion, empyema, lung abscess and multilobar infiltrates are associated with longer hospital stay and shock [2]. Respiratory failure, sepsis and cardiac complication are considered the most important direct causes of death among patients with pneumonia [3,4]. Risk factors for acquiring pneumonia were clearly detected by previous studies [5,6]. However, there are lack of studies that investigate risk factors and predictors for poor pneumonia outcome in children. The interaction between gender and CAP is intermingled, no role of gender was found in some studies [7], while males are more prone to be hospitalized due to CAP than females in others [8]. It has been evidenced that there is interaction between platelets and bacterial infection. During bacterial infection, platelets play a role in host defence [9]. The white blood count has an important role in predicting the invasive bacterial infection [10]. Anaemia is associated with acute bacterial infection; there is inverse relationship between total leucocytic count and haemoglobin level [11]. The hypothesis of this study is that gender and findings of complete blood count at the time of diagnosis of community acquired pneumonia (CAP) can affect outcome and can be considered as risk factors for poor prognosis of the disease. The objective is to determine risk factors present on the moment of admission to hospital that may guide clinicians recognizing this case as one with a potential bad outcome. The studied risk factors were male sex, anaemia, leucopaenia, leucocytosis, thrombocytosis and thrombocytopaenia. These factors can be easily elicited during routine initial history and laboratory investigation. Initial recognition and identification of these predictors allow early appropriate intervention which can help improving pneumonia outcome.

Methods

Study design and methods

A prospective cross-sectional study was conducted in a tertiary health centre. The study enrolled 242 patients, 135 males and 107 females who were diagnosed as CAP. Work for the study started at October 2012 and ended at August 2014. Diagnosis, hospitalization and management were according to British Thoracic Society guidelines for the management of community acquired pneumonia in children: update 2011 [12]. The protocol for the research project has been approved by the regional Ethics Committee. All experiments were carried out in compliance with the relevant laws and guidelines in accordance with the ethical standards of the declaration of Helsinki. Informed consent was obtained from the parents after approval of the experimental protocol by a local hums man ethics committee (Revised January 2008).

Participants

Children aged from 1 month to 12 years who diagnosed as CAP were included in the study. The diagnosis was based on clinical (tachypnea, chest indrawing, nasal flaring, crackles and bronchial breathing) and radiological (chest infiltrates) evaluations. [12].

Exclusion criteria

Children aged less than 1 month.

Patients with associated other comorbidity (cardiac, renal, hepatic or haematological diseases, immunodeficiency diseases, chronic chest diseases, chronic inflammatory diseases, and neurological diseases either upper or lower motor neuron diseases).

Procedure

On arrival the following interventions were done for the patients:

1. Complete medical history and physical examination.
2. Complete blood count (CBC), C reactive protein (CRP).
3. Anteroposterior and lateral chest X rays.

The following data were recorded: sex and age of the patient, platelet count (normal, high or low according to reference range for sex and age), total leucocyte count (normal, high or low according to reference range for sex and age), haemoglobin level (normal or low according to reference range for sex and age). The reference standard was estimated by an electronic cell counter. We used the hospital information system to retrieve the test results of all study patients. Sputum culture was not universally done, but it was done on failure of clinical or radiological improvement after empirical treatment – Presence of severe disease at the time of pneumonia presentation which is detected by the presence of at least one of the following findings, flaring of the nostrils, respiratory failure, cyanosis, torpor/coma, irritability, sepsis or shock [12].

After diagnosis of pneumonia, patients received appropriate treatment which is recorded. Continuous observation and follow up were done for all patients with special emphasis on symptoms, signs, laboratory finding and radiological finding of sepsis and pulmonary complications. Diagnosis and management of empyema were according to British guidelines for the management of pleural infection in children [13]. Lung abscess was suspected by physical examination and X ray and confirmed by computerized tomography [14]. Sepsis was diagnosed according to the criteria of International Consensus Definitions for paediatric sepsis (core temperature of $> 38.5\,°C$ or $< 36\,°C$, tachypnea $> 2SD$ for age, tachycardia $> 2SD$ for age with the absence of external stimulus plus evidence of infection). [15]

Variables

We studied the effect of sex, abnormal thrombocyte count, abnormal leucocyte count and anaemia on pneumonia outcome which was represented by the following parameters, development of pulmonary complications, sepsis and death.

Statistical analysis

Collected data were computerized and analysed using the Statistical Package for Social Science (SPSS) version 20. Descriptive statistics were used to describe variables; percentage and proportion for qualitative variables. Quantitative