OLGU SUNUMU CASE REPORT

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Severe Pertussis Pneumonia in an Infant: Treated with Exchange Transfusion: Case Report

Ciddi Boğmaca Pnömonisi Olan Bir İnfantta Kan Değişimiyle Tedavi

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ABSTRACT Pertussis, becomes serious when refractory hypoxemia develops from hyperleukocytosis and pulmonary hypertension, especially in infants. Here, we present the case of a 2 months-old infant with severe pertussis pneumonia and hyperleukocytosis. A double volume exchange transfusion (ET) was needed for cardiopulmonary insufficiency unresponsive to intensive care. Oxygenation gradually improved within 48 hours after the treatment. A high white blood cell count can be a predictor of death in infants with pertussis. We considered that clinical improvement was observed due to a reduction cluster of leukocytes and also toxins, because of pertussis is a toxin-releasing infection. The early use of ET may prevent fatal outcomes in infants with severe pertussis, who failed to respond to standard therapy.

Keywords: Bordetella pertussis; exchange transfusion, whole blood; leukocytosis

ÖZET Boğmaca, hiperlökositoz ve pulmoner hipertansiyona bağlı refrakter hipoksemi geliştiğinde özellikle infantlarda ciddi seyredebilmektedir. Biz burada hiperlökositozu olan ve ağır boğmaca pnömonisi gelişen 2 aylık bir infantı sunduk. Yoğun bakım tedavilerine yanıtsız kardiyopulmoner yetmezliği olan hastaya, çift volüm kan değişim uygulandı ve oksijenizasyon 48 saat içinde giderek düzeldi. Yüksek lökosit sayısı, boğmacası olan infantlarda mortalite için belirleyici faktör olabilmektedir. Boğmaca toksin salan bir enfeksiyon olduğundan, hastamızdaki klinik iyileşmenin, beyaz küre sayısındaki düşüşle birlikte, toksin azalmasına da bağlı olduğunu düşünüyoruz. Standart tedaviye yanıt vermeyen ağır seyirli boğmacada, kan değişiminin erken uygulanması ölümcül sonuçları engelleyebilmektedir.

Anahtar Kelimeler: Bordetella pertussis; transfüzyon, tam kan; lökositoz

Pertussis is a life threatening infectious respiratory disease, caused by *Bordetella pertussis*. An estimated 50 million cases and 300.000 deaths occur every year; with case-fatality rates in developing countries as high as 4% in infants. The clinical diagnosis of pertussis is based on coughing and illness lasting ≥2 weeks with one of the following symptoms: paroxysmal coughing or inspiratory "whoop," or posttussive vomiting, or apnea. Pertussis is highly contagious and transmission occurs via the liquid droplets expressed by coughing. Although, *Bordetella spp.* can be recovered from nasopharyngeal specimens, the laboratory diagnosis is generally made via polymerase chain reaction (PCR) test and the detection of specific antibodies. Infants with pertussis, frequently required hospitalization: apnea,

pneumonia are common, with seizures, encephalopathy, and mortality occuring rarely.[1]

Supportive care (hydration, nutrition and cough prevention) is main form of the treatment. Early macrolide treatment is may be effective on symptoms, but main purpose is eradicating of nasopharyngeal carriage. Azithromycin being preferred in the first six weeks of life (risk of hypertrophic pylor stenosis). Severe pertussis pneumonia characterized by respiratory and cardiac failure frequently necessitate intensive care.[2]

Severe leukocytosis defined as white blood cell (WBC) count higher than 100.000/μL is an independent predictor of death. In addition lymphocytosis, caused by the pertussis toxin (PT), leads to obstruction and hyperviscosity in the pulmonary arterioles and can cause pulmonary hypertension, and/or respiratory and cardiac failure.[3]

An exchange transfusion (ET), leukofiltration or extracorporeal membrane oxygenation (ECMO) can be used for hyperleukocytosis, but high mortality rates can still be seen. ET, the safest leukoreduction method removes the PT and reduces the WBC count.[4]

CASE REPORT

A 2 months-old girl was admitted to our facility with coughing, dyspnea and cyanosis. Her symptoms began one week previously, becoming worse over the last two days. She was not vaccinated against pertussis. Nasal flaring, prolonged expirium, intercostal retractions and crackling sounds (in both lungs) were observed (oxygen saturation 85%, temperature 37.2°C, heart rate 160/bpm and respiratory rate 60/min): therefore, she was intubated. Her WBC count was 85×10^3 cells/mm^3 (neutrophil 24%, lymphocyte 56%, hematocrit 27,8%; platelet count 385×10^3/mm^3), and C-reactive protein 4 mg/dL, and peripheral blood smear examination was normal. *B. pertussis* and *Streptococcus pneumoniae* were detected via PCR (nasopharyngeal swab sample), and azithromycin and cefotaxime were ordered. Despite high airway pressures via mechanical ventilation, the hypoxia, tachycardia (190/min), and tachypnea (80 breaths/min) persisted and the chest images showed worsening. The echocardiogram was normal, including the pulmonary artery pressure. The double volume ET was performed on the 8th day after hospitalization without any complication. The WBC counts fell from $56x10^3$/mm^3 to $27x10^3$/mm^3 within 24 hours and the oxygenation, heart rate and respiratory rates normalized within 48 hours. The patient was extubated four days later and discharged from the intensive care unit. Azithromycin and cefotaxime treatment complated after 10 days, and she was discharged after 3 weeks of hospitalizations (WBC $18x10^3$/mm^3 and lymphocyte predominance).

DISCUSSION

Severe pertussis disease remains a significant problem especially for children under 6 months of age. Because it is a toxin-releasing infection, antibiotic treatment have restricted effects; therefore, supportive care is paramount in its management.[5]

Cardiopulmonary failure, severe leukocytosis, neurological involvement and severe pulmonary hypertension can cause death, despite intensive treatment.[6,7]

The leukocytes aggregate leads to the obstruction of the pulmonary arterioles and is manifested clinically by dyspnea and tachypnea.[3] In severe pertussis, leukoreduction can reduce mortality before development of organ failure. ET can reduce the cluster of WBCs in the small pulmonary vessels, improving oxygenation, and reduce PT to prevent cardiac and pulmonary damage. Which effect is more important is still unknown. ET should be considered in patients who do not respond to standard treatment in severe pertussis. Especially, the clinical features of severe pertussis included WBC that 30×10^9/L, heart rates >170/min, and respiratory rates >70/min. We performed double volume ET immediately after clinical deterioration was observed in this patient.[2] The need for mechanical ventilation requirement and leukocytosis persisted in our patient despite hydration and intensive care until the ET was performed. The echocardiography was normal upon admission and during the follow-up period. We

believe that the poor clinical status was greatly associated with the PT effects. Because PT causes lymphocytosis by rerouting lymphocytes to remain in the circulating blood pool. Hereby, the removal of toxins via ET was more effective in our patient. Clinical improving in the cardiorespiratory status was developed with WBC count got below $30x10^3/mm^3$ quickly within 24 hours. In case of Chantreuil et al., 2.5-month-old girl hospitalized with critical pertussis, and WBC $70x10^9/L$. ET was successfully performed with a reduction of leukocytes to under $40x10^9/L$ followed by steady improvement of pulmonary function.[8]

A high WBC count can be a predictor of death in infants with severe pertussis. Therefore, ET should be performed early in the course of the disease, especially before pulmonary hypertension and multiorgan failure develop.

Conflict of Interest

Authors declared no conflict of interest or financial support.

Authorship Contributions

Conception: Constructing an idea or hypothesis for research and/or manuscript: *Melike Keser Emiroğlu, Gülsüm Alkan;* ***Design:Planning methodology to reach the conclusion:*** *Gülsüm Alkan, Melike Keser Emiroğlu;* ***Checking: Organize the work:*** *Melike Keser Emiroğlu, Gülsüm Alkan;* ***Data Collection:Taking responsibility in execution of the experiments, patient follow-up, data management and reporting:*** *Gülsüm Alkan, Melike Keser Emiroğlu;* ***Analysis and/interpretation: Taking responsibility in logical interpretation and presentation of the results:*** *Gülsüm Alkan, Melike Keser Emiroğlu;* ***Literature Review: Taking responsibility in this necessary function:*** *Melike Keser Emiroğlu, Gülsüm Alkan;* ***Writer:Taking responsibility in the construction of the whole or body of the manuscript. All authors read and approved the final manuscript:*** *Gülsüm Alkan, Melike Keser Emiroğlu.*

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