



Case Report

<http://crcp.tums.ac.ir>**Exchange Transfusion in Management of Fulminant Pertussis: A Case Report**

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ABSTRACT

Pertussis incidence is increasing worldwide especially in infants < 2 months old with high mortality rate. Fulminant pertussis is characterized by refractory hypoxemia, cardiogenic shock, pneumonia, and intense leukocytosis that certainly needs intensive care and can lead to 75% mortality rate. Leukoreduction measures especially exchange transfusion (ET) have been used with some successful outcomes. We report ET as a treatment in a case of malignant pertussis with multi-organ failure syndrome. A 57-day-old infant who was admitted in pediatric intensive care unit with severe paroxysmal cough and extreme leukocytosis that despite appropriate treatment and full supportive care progressed to seizure, renal failure, pulmonary hypertension, and shock state, but his condition improved after ET. The patient was discharged from our hospital in good condition. ET even in the presence of multi-organ failure may be lifesaving and should be considered.

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Introduction

By 2004 the incidence of pertussis was 8.9 cases/100,000 in general population and 150/100,000 in lower than 2-month olds (1). About half of infant cases are infected by close contacts from elders with waned immunity (5-10 years after immunization) (2). Pertussis was reported to be the leading cause of mortality related to

infection in infants younger than 2 months of age (3). Fulminant pertussis is characterized by refractory hypoxemia, cardiogenic shock, pneumonia, and intense leukocytosis that certainly needs intensive care and can lead to 75% mortality rate (3).

Case Report

A 4.5 kg, 57-day-old infant presented with

dyspnea and cough induced cyanosis. His problem started 12 days ago with paroxysmal cough and mild fever that had been aggravated since the previous 2 days. He was prescribed oral antibiotics before admission. The cough was more severe during sleep and triggered by any stimulation. Gradually the patient developed poor feeding, decreased urination and respiratory distress. At the time of admission, the patient was ill with respiratory distress. The oxygen saturation was 96% while receiving oxygen with headbox. On physical exam, rales were heard on both lungs. He was lethargic, dehydrated and with respiratory distress. Chest radiography revealed lung hyperinflation and consolidation, especially around hilum. In the 2nd day of admission, the patient developed one episode of generalized seizure that was controlled by diazepam. Due to a paroxysmal cough and extreme leukocytosis [white blood cell (WBC): 81,700/mm³ with 59% lymphocyte], on the 3rd day of admission, nasopharynx culture for pertussis was requested and oral azithromycin plus intravenous sulfamethoxazole and trimethoprim was administered on the same day the patient's respiratory condition deteriorated rapidly requiring intubation and mechanical ventilation. On the 4th day, WBC peaked to 96,100/mm³ with 55% lymphocyte and 40% neutrophil and thrombocytosis (platelet: 686,000/mm³). In few hours the patient developed mixed respiratory and metabolic acidosis with hypotension and anuria. Kidney sonography was performed to rule out renal vein thrombosis but suggested acute tubular necrosis due to echogenicity and disappearance of corticomedullary differentiation. Due to anuria, peritoneal dialysis was performed. Echocardiography confirmed pulmonary hypertension. In spite of taking epinephrine and dopamine drip, he still had hypotension (systolic blood pressure: 44 mm Hg) with heart rate of 185 beats/minute. Electroencephalographic monitoring was done and reported "no epileptic waves." On the 5th day of admission, we decided to

perform exchange transfusion (ET) after we got informed consent for the procedure from his father, as there have been some case reports with good outcomes (3, 4). By the way of two femoral lines, a 1.5 patient's blood volume ET was done using whole blood. One hour after ET, WBC count decreased to 21,000/mm³ and platelets to 90,000/mm³. Two hour after ET the patient's hemodynamic improved gradually and epinephrine and dopamine were discontinued one by one. Heart rate decreased to 130-140 beats/minute. Urine flow started again on the next day. At the 8th day of his admission in pediatric intensive care unit (PICU), the patient was extubated successfully. He had still some degrees of tachypnea that gradually improved, and finally, he was discharged from PICU after 20 days.

Some variables are compared before and after ET in table 1.

Table 1. Clinical and laboratory changes before and after ET

Variables	Before ET	After ET
Heart rate (beat/min)	185	130
Blood pressure (mm Hg)	43/pulse	75/40
Respiratory (rate/min)	85	75
WBC count (/mm ³)	96,100	21,000
Platelet (/mm ³)	686,000	90,000
Calcium (mg/dl)	8.5	6.7
Creatinine (mg/dl)	2.4	1.9

ET: Exchange transfusion, WBC: White blood cell

Discussion

Despite vaccination, pertussis is an important cause of infant death worldwide, and it is still a public health concern. According to the World Health Organization report, in 2008 the estimated mortality was approximately 195,000 children (5). Pertussis affects all ages, but a fulminant course may occur in young infants who are mostly not completely immunized without the classic stages of pertussis (6). In addition to hallmark paroxysmal coughing, pertussis in young infants is frequently characterized by significant leukocytosis. We sent nasopharynx culture for pertussis on the 3rd day of

admission that was reported negative despite the full clinical presentation that correlated with pertussis. According to literature, the presence of leukocytosis with lymphocytosis in a child with a cough or the presence of apnea in an infant is a strong indication that the illness is caused by *Bordetella pertussis* (7). Our patient had taken antibiotics before admission, and the culture was sent more than 2 weeks after onset of cough. Based on Le et al. (8), the culture will be positive in approximately 80% of cases if the specimen is obtained within 2 weeks of onset of cough and antibiotics have not been administered previously. Hence, according to these facts, in spite of the negative culture, we still consider pertussis as the main diagnosis.

In infants < 4 months old, the severity of disease and mortality is directly related to WBC count (9). A recent study of California Department of Public Health that involved 31 infants < 90 days old admitted in PICU, indicated that patients with pulmonary hypertension and/or who deceased, had higher WBC counts, pulse and respiratory rates (10). In our patient, raising WBC was also accompanied with worsening clinical condition.

Leukocytosis in pertussis has been explained since the late 1800s, and as it exists in the large majority of the patients, it is considered to be of diagnostic value (9). In addition, infants affected with *Bordetella parapertussis* which does not produce pertussis toxin (PT) do not develop leukocytosis (11). Discovering the mechanism of leukocytosis induced by PT, several studies found that the most probable mechanism is the inhibition of lymphocyte extravasation (12).

Severity of leukocytosis is related to mortality (7). Winter et al. (12) found that leukocytosis above 70,400 was especially predictive of death particularly when accompanied by low birth weight. Leukoreduction measures such as leukapheresis and ET have been used to reduce mortality. So attempts to decrease the WBC mass may be helpful by preventing stasis related problems. Romano et al. (13)

indicated that leukoreduction by ET in infants with critical pertussis decreased the mortality rate from 44% to 10%. By ET, we aim to decrease the WBC mass as much as possible to prevent leukocyte aggregation in blood vessels and pulmonary hypertension. ET not only removes the leukocyte mass but also eliminates pertussis toxins and other possibly harmful inflammatory mediators. Acute improvement in clinical condition could be due to leukocyte mass removal. This mechanism is supported by the fact that leukemic patients with very high WBC counts and respiratory distress also improve after ET (14). According to Nieves et al. (15), ET should be done before multi-organ failure occurs and in one study all expired patients had renal failure.

Our patient had developed renal failure but survived by ET, so, it seems that the sooner ET is performed the better can be the outcome, but even in the presence of multi-organ failure, ET may be lifesaving and should be considered. Again according to Nieves et al. (15) ET in infants < 90 days old who are infected by pertussis should be considered when WBC > 30,000/mm³, heart rate > 170/minute, or respiratory rate > 70/minute.

As we know, this is the first report of ET for the treatment of pertussis in Iran.

Conflict of Interests

Authors have no conflict of interests.

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