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Severe Pertussis Pneumonia managed with Exchange Transfusion

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Abstract

We describe in this case report one month old baby admitted to our Pediatric Intensive Care Unit (PICU) with severe pertussis pneumonia. The baby was deteriorating despite being on supportive management including High Frequency Oscillator ventilation (HFOV). However, she showed dramatic improvement after exchange blood transfusion (ET) and was discharged home. We hope that this report will add to the previously published experiences in management of severe pertussis. It will also alert general physicians about pertussis pneumonia and the importance of early referral and abrupt management for a better prognosis.

Keywords: Severe pertussis; leukocytosis; whole blood exchange transfusion; leukopheresis; pneumonia.

Introduction

Severe pertussis pneumonia can be associated with refractory hypoxemia, pulmonary hypertension, cardiogenic shock and extreme leukocytosis. It is a fulminant condition affects mainly small infants and associated with high mortality rate.[1] The management is mainly supportive and it includes mechanical ventilation (conventional or high frequency), nitric oxide and Extracorporeal Membrane Oxygenation (ECMO) in extreme cases.[2]

Severe and fatal pertussis has been correlated with the degree of lymphocytosis, a clear manifestation of pertussis toxin. Therefore, exchange blood transfusion (ET) and leukophoresis have been reported to be used as methods to reduce leukocytes load to improve patient's outcome.[3] We report a case of severe pertussis pneumonia managed with exchange transfusion.

Case Report

One month old female infant admitted to the hospital with 6 days history of paroxysmal cough preceded by Upper Respiratory Tract Infection and associated with facial congestion, cyanosis, occasional vomiting and mild fever. The baby was born normal. She did not yet receive pertussis vaccination.

On admission she was mildly tachypnic but not in respiratory distress, Oxygen saturation was 95% on 2L/m nasal cannula, mildly dehydrated and hemodynamically stable. Initial Chest X-Ray showed right upper and middle lobe consolidation, total WCC- 38,000/μL and lymphocytes 24,000/μL. She was started on Clarithromycin and Cefotaxime, adrenaline neubilizer, IV fluids, Nasal cannula Oxygen and frequent suctioning.

On day 3 of admission; the baby was more sick; more tachypnic, RR- 70/m, in severe respiratory distress, high Oxygen requirement and persistently tachycardic HR up to 200/m. Repeated investigations showed worsening in lung consolidation, hypercapnia and increase in WCC- 73,500/μL. The baby was intubated and required High frequency oscillatory ventilation (HFOV). She remained hemodynamically stable and did not require inotropic support. ECHO showed no pulmonary hypertension. Antibiotics were changed; she received Tazocin for 10 days, Vancomycin for 5 days and Oseltamivir for 5 days.

Leukocytosis persisted despite good hydration; repeated WCC was 63.600/μL and there was no improvement in the baby's clinical condition. An exchange transfusion with single volume replacement was performed with no adverse events. The WBC count decreased to 50,000/μL. 29 hours from the first ET, another exchange transfusion with single volume replacement was performed as the WBC remained high 50.200/μL and no much improvement in the patient clinical condition.

The patient showed good improvement after the second ET and WCC decreased to 26.6000/μL and remained relatively low. He was weaned from HFO to conventional mechanical ventilation on day 2 post ET. On day 14 of admission the patient was discharged from the PICU and from the hospital on day 19. B. pertussis was detected by PCR on nasal secretions.

Discussion

Pertussis continues to be a significant cause of childhood morbidity and mortality, giving rise to 200,000–400,000 deaths every year, mostly in developing countries.[4] More than half of the severe cases requiring intensive care manifests in infants too young to be vaccinated. Most of the serious complications and deaths related to pertussis are seen in this age group.[5,6]

Severe pertussis is associated with refractory hypoxemia, cardiogenic shock, pneumonia and extreme leukocytosis, >50,000/μL leukocytes. It is a fulminant complication of a subset of young

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infants infected with Bordetella pertussis.[1] It is associated with up to 80% mortality.[7] A study done in the Royal Children's Hospital, Melbourne; the main reasons for admission to the PICU for patients with pertussis were apnea with or without cough paroxysms (63%), pneumonia (18%), and seizures (10%). Most of the patients admitted to PICU are infants less than 6 months of age. Almost all children were unimmunized at the time of admission. The study showed that Infants presenting with pneumonia presented earlier, had longer intensive care stay, higher white cell count, lower PaO2 at admission and higher mortality.[2]

The above study indicated that poor outcome and high mortality rate is associated with pertussis if the main indication for PICU admission is pertussis pneumonia. Patients with pneumonia can be severely ill and develop severe pulmonary hypertension, severe cardiovascular compromise and multi-organ failure. Some of them might need ECMO support. In the Melbourne study, deaths occurred in infants who had pneumonia at presentation and most of them died with severe pulmonary hypertension and multi-organ failure including circulatory failure and all those placed on ECMO did not survive.[2]

The pathogenesis of severe pertussis is not clear. Pathologic studies of children who died from severe pertussis have shown immature leukocytes in pulmonary arterioles, small arteries and venules. Some authors have accepted that the leukocyte mass in patients with hyperleukocytosis could obstruct pulmonary microcirculation, leading to pulmonary hypertension with heart failure and hypoxemia.[8,9]

Many small studies have shown that infant deaths with pertussis relate directly to the degree of leukocytosis. Hence, attempts have been made to lower the white blood cell count, by double volume exchange transfusion. A number of experiences in case studies suggest that exchange transfusion has been useful. Unfortunately no controlled studies have been done. However, If ET is planned in an infant it should be done before organ failure has occurred.[3]

The decision for ET should be based on the early appearance of pneumonia, the presence of pulmonary hypertension and the rapidity in the rise of the WBC count. This requires that WBC counts to be performed every 12 to 24 hours. Rapidly rising counts that reach 30,000 /μL should prompt immediate consideration of ET. Also, rapidly increasing pulse and respiratory rates should also be considered as indicators for performing ET.[3]

In our case the decision to perform ET was made early in time before the patient develops pulmonary hypertension and becomes hemodynamically unstable taking in consideration the rapid rise in WCC. Because ET in severe Pertussis pneumonia was a new experience for us and the patient was still in respiratory failure despite being on HFOV, we opted to do it using single volume replacement in two sessions instead of double volume as reported in literature. The patient tolerated the procedure and had full clinical recovery. Two sessions single volume ET might be as effective as one session double volume ET and might be safer especially in hemodynamically unstable patients.

Conclusion

Management of severe pertussis pneumonia with leukocytosis can be augmented with ET in addition to the usual supportive measures. This might help to reduce mortality. However, current experiences about use of ET in this condition are mainly from single case reports or case series. To clearly describe the risks and benefits of these therapies prospective studies are needed.

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