

A CASE STUDY OF NEONATAL ORGANOPHOSPHATE POISONING PRESENTED AS ACUTE RESPIRATORY DISTRESS

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ABSTRACT

Introduction: Organophosphorus Compounds Intoxication [OPCI] is a likely fatal but completely manageable condition that is still quite common in our country. Early diagnosis is crucial in preventing fatality. Although rarely reported, it occurs in infants. However, history may not be forthcoming and initial presentation often deceptive.

Case report: We report a case of neonate admitted to the neonatal intensive care unit (NICU) of Abu El-Reish Hospital; Faculty of Medicine; Cairo University with respiratory distress, pinpoint pupils and hypotonia. The symptoms appeared after spraying the home by insecticides. Plasma pseudocholinesterase level appeared to be low, consistent with acute intoxication with organophosphorus insecticide.

Treatment: Management of OPCI consists of airway management, administration of oxygen and fluid, as well as atropine in increasing doses and obidoxime (Acetylcholine esterase reactivator). Plasma pseudocholinesterase analysis is a cheap and an easy measurement for OPCI. And it could be used for diagnosis and treatment monitoring.

Keywords:

Organophosphorus compound; pseudocholinesterase; intoxication; neonate

INTRODUCTION

Organophosphorus Compounds Intoxication [OPCI] promotes irreversible depression of acetylcholinesterase. Organophosphates phosphorylate the serine hydroxyl group of acetylcholine, ending up with the accumulation of acetylcholine at the cholinergic synapses (Aygün, 2002).

Accumulation results in muscle weakness and fasciculation. Regarding the central nervous system, the neural transmission will be interrupted. However, if this inhibition was not reversed in the first 24 hours, considerable quantities of acetylcholinesterase could be destroyed permanently (Leibson & Lifshitz, 2008).

Organophosphorus compounds (OPC) are frequently utilized in agricultural manufacture, such as insecticides and defoliants. They are quickly absorbed by entire ways of exposure, which include respiratory, gastrointestinal, and dermal routes. These compounds will irreversibly

suppress the acetylcholinesterase enzyme at the cholinergic synapses, leading to a surplus stimulation of the cholinergic transmission in the neuromuscular junction, the sympathetic as well as the parasympathetic nervous systems, and the central nervous system (Leibson & Lifshitz, 2008).

Acetylcholinesterase is usually found in the RBCs and the nicotinic and muscarinic receptors. Cholinesterase measurement in the blood is fundamental in the determination of the seriousness and the clearance time of OI. This occurs via measuring plasma pseudocholinesterase (PCE). Another tool is the cholinesterase level in the erythrocytes (which reflects the cholinesterase in neuromuscular junctions and neurons). The prior method is more available and more popular (Aygün, 2002).

Organophosphate poisoning treatment includes airway assurance, providing with oxygen, fluid, along with atropine in rising doses fashion besides pralidoxime. Treatment is

directed to decontamination, reperussion of the muscarinic symptoms with atropine and initiate activation of the enzyme through oximes given (**Hoffman RS, Nelson 2007**).

The aim of the case study is to discuss rare case of OP poisoning in newly born infant presented as respiratory distress.

CASE REPORT

We present a case of pneumonia with progressive symptomatology that leads us to diagnose OPCI.

A previously healthy full-term male (2940 grams) baby, born by uncomplicated vaginal delivery, he is the third infant of non-consanguineous parents with a rural background. He presented at age of 11- day-old with vomiting during breastfeeding which was followed by distressed respiration and hypotonia. No previous history of fever, seizures, respiratory sickness, or drug was given. He was seen briefly at the causality but was admitted directly to the Neonatal Intensive Care Unit (NICU) for further assessment and support.

Initial assessment revealed severe respiratory distress. He was well thriving and afebrile. He was hypotonic and the pupils were small, sluggishly reacting on both sides, his heart rate was 150 beats/min (normal heart rate for this age is 110-160 per minute) (**Advanced Life Support Group, 2005**). The heart sounds were normal with no audible murmur. Respiration was shallow, with a rate of 60 /min (normal respiratory rate for this age is 30-40 per minute) (**Advanced Life Support Group, 2005**). Subcostal and intercostals retractions with bilateral wheezing and excessive bronchial secretions were observed. Oxygen saturation (SPO₂) was 81% on room air. His blood pressure was 80/60 mmHg, with adequate perfusion and capillary refill time less than 3 sec. An abdominal examination revealed no abnormality. Within the first 3 hours, his pupils turned pinpointed and were not reactive to light. Profuse oral and pharyngeal secretions along with diarrhea were prominent as well. This group of symptoms made the cholinergic hyperactivity highly suspected. To confirm, cholinesterase [ChE] level (**EI-Naggar et al, 2009**) was done and was found to be 2030U/L (laboratory reference level > 3000U/L).

On admission, he was provided oxygen support (3-4 L/min through nasal prongs, initially). But he desaturated to SPO₂ of 45%, Resp rate >40/min, HR 150/min. Acute cholinergic syndrome was expected with respiratory failure, so fast decision was taken for intubation and mechanical ventilation (**Hulse et al., 2014**). Initial ventilatory parameters were SIMV PIP 17/ PEEP 5 - Rate 60/min decreased gradually to 35. Fio₂ initially 100%, then dropped to 40 %, then weaned after starting obidoxime and atropine to nasal oxygen 2 liters per minute which weaned gradually to off oxygen within 2 days. Initial Arterial blood gases (ABG) confirmed mixed respiratory and metabolic acidosis, but subsequent assessments were mainly metabolic acidosis. His laboratory investigations revealed CRP negative, normal Full blood picture (no leukocytosis), hyperkalemia and hyponatremia. First chest x ray was suspicious for pneumonia, but that was clearing up on subsequent assessments with exclusion of pneumonia or pneumonitis as evidenced by almost normal x-rays.

Intravenous (IV) fluids and IV antibiotics were started on admission. IV fluids (Normal saline mainly) were given in a rate of 70 ml/kg/day that was increased by 10 ml/kg/day gradually. The antibiotics included ampicillin 150mg (50 mg/kg) every 8 hours, and gentamycin 20 mg (4mg/kg) that were started empirically for the possibility of aspiration pneumonia. However, cultures, chest x-ray and metabolic figures were within normal ranges.

Atropine infusion was immediately commenced at a rate of 0.02 mg/kg/hour (**Hoffman & Nelson 2007**), measured to dry the secretions. Due to the unknown nature of the OP compound, a tentative dose of obidoxime, 5 mg/kg, was provided to initiate reactivation of the ChE enzyme (**Hoffman & Nelson 2007**).

Over the following 24 h, the baby has experienced good improvement in power and motor tone as well as dryness of secretions. The parents later mentioned that they had sprayed an insecticide around the house earlier on the admission day and the child most probably was exposed to it through the inhalation route. Atropine was provided for 2 days and then weaned gradually over the following 24 hrs.

Follow-up monitoring of ChE levels displayed a steady elevation in titers to normality (3100U/L). The patient was discharged on the 10th day and advice was provided on the risks of exposure to OPCI in the surrounding environment.

DISCUSSION

Our patient experienced some features of hypersecretions; CNS depression; bilateral miotic pupils and respiratory distress. This combination of symptoms is strongly indicative of a cholinergic toxidrome with inquiry disclosed exposure to OPC.

For our case, the absorption occurred through multiple routes, respiratory tract, skin, and mouth while spraying the solution around the house.

Most cases of OPCI in children are via the oral route, such as contaminated food or containers, or an infant's prominent act to put anything accessible in his mouth if unwatched. Cases of the transplacental pathway for OPCI in the newborn were reported (**Jajoo et al. 2010**).

Although pediatric cases statistics are scant, it is a serious problem. A study was done in Nicaragua by the WHO displayed figures which suggested that 19% of cases of occupational incidence there are in youths aged less than 16 (**McConnell & Hruska 2008**).

OPC suppress ChE activity and affect nicotinic receptors of central and peripheral muscarinic receptors (**El-Naggar et al. 2009**). Unlike adults, infants mostly display acute depression of CNS without typical muscarinic effects such as bradycardia and fasciculation. Examination of the pupil is crucial (**Hon et al. 2008**) and diarrhea with pinpoint pupils on presentation is known as an early triage tool for toxicity diagnosis in children (**Bond et al. 2008**). On presentation of our case, periodic pupil examination managed to disclose the diagnosis.

The foremost treatment should be to secure and maintain a patent airway and to assure sufficient gas exchange and organ perfusion. This should be followed with efforts to establish a proper diagnosis and management.

Tachycardia, more than bradycardia, was recorded on presentation in 49% of children suffering OI (**Zwiener & Ginsburg 1988**).

The respiratory distress in our case has mainly multifactorial origin because of bronchospasm and secretions due to muscarinic excitation. Additionally, nicotinic receptors stimulation leads to paresis after the weakness of the respiratory muscles (**Nel et al 2002**).

The differential diagnoses for our case were infection, such as meningitis, empyema, intracranial abscess, complicated pneumonia, and sepsis. Others were head injury, hemorrhagic or other cause of intracranial hemorrhage and ischemic encephalopathy. Besides, accidental, or deliberate poisoning and inborn errors of metabolism were also possible underlying causes. Poisons other than OPC were also suggested. Different herbal remedies, barbiturates, alcohol, opiates, ketamine, and chloral hydrate are all possible causes for reduced consciousness and meiosis. However, they do not manifest as profuse secretions nor as pulmonary edema. Besides, the last-mentioned agents are hard to obtain in rural areas. Severe pneumonia may present with severe respiratory symptoms with reduced consciousness, but meiosis is not common. If there is abscess formation, meningitis may cause unilateral pupillary abnormalities. Head injury may be another remarkable differential diagnosis. The patient displayed a normal anterior fontanel, with no injuries were detected. Another suggestion was inborn errors of metabolism, but blood glucose was normal besides the lack of any organomegaly made this possibility unlikely (**O'reilly & Heikens, 2011**).

Acute OPCI is a clinical diagnosis. The cholinesterase level in RBCs is usually noticeably suppressed. However, this laboratory test is rarely easily available. Despite diminished plasma levels of PCE, a little correlation regarding acetylcholinesterase activity in either the brain or at the neuromuscular junction can be detected (**Bardin et al. 1994**). However, the decreased PCE readings could help as an exposure marker of OPC and initiate the diagnosis. Consequently, the diagnosis is, therefore, depending on the exposure history, cholinergic toxidrome presentation, and regression or symptoms cessation after proper treatment (**O'Malley, 1997**).

The aim of the treatment is decontamination, a cessation of the muscarinic signs through atropine and activation of the enzyme by oximes.

Multiple doses of atropine or titrated continuous infusion are aimed to dry the secretions. A single dose of obidoxime is given or in a continuous infusion is provided in severe poisoning. Continuous oximes infusion is given for 24 h after cessation of symptoms or restoration of the normal level of ChE in serum (**Hoffman & Nelson 2007**).

The central or nicotinic cholinergic signs or symptoms are not reversed through atropinization, especially muscle weakness or paralysis. A variant dose of obidoxime or a continuous infusion is used in difficult cases until the occurrence of resolution of the symptoms or normal plasma PCE levels restoration (**Clark, 2002**).

This antidote is believed to be used as early as is deemed appropriate before irreversible suppression of acetylcholinesterase occurs. A loading dose of 4-8 mg/kg followed by a repeated administration, or a continuous infusion of 1 mg/kg/h is provided until fasciculation and muscle weakness get settled (**Schexnayder 1998**).

OPCI is a common trigger of respiratory distress and suppressed consciousness at young age and must be alerting even in the absence of a strong history of exposure, especially in regions where these products are commonly utilized. A history suggestive of probable topical exposure, particularly in a neonate with a considerable large surface area, should be investigated. To our knowledge, this is the youngest infant reported to have been poisoned with Ops in Egypt.

CONCLUSIONS

OPC misuse, especially in domestic applications, can be fatal.

PCE analysis is an accessible indicator of OPC and can be used for treatment effectiveness monitoring.

Atropine should be used as early as deemed appropriate to counteract the muscarinic effects. Appropriate management and early diagnosis of the complications may suppress the death rate.

RECOMMENDATION

Good history taking and thorough examination is a must for pediatric age group to exclude possibility of poisoning as a hidden cause of sudden physiologic derangement

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الملخص العربي

دراسة حالة لتسمم الفوسفات العضوي في حديثي الولادة كسبب لاضطراب تنفسي حاد

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التسمم بالفوسفات العضوي هو حالة قاتلة على الأرجح، ولكن يمكن التحكم فيها تمامًا ولا تزال شائعة جدًا في بلدنا. التشخيص المبكر أمر بالغ الأهمية في الوقاية من الوفيات. على الرغم من أنه نادرًا ما يتم الإبلاغ عنه، إلا أنه يحدث عند الرضع. ومع ذلك، قد لا يكون التاريخ وشيكا وغالبًا ما يكون العرض الأولي خادعًا. نبلغ عن حالة مولود جديد تم إدخاله إلى وحدة العناية المركزة لحديثي الولادة (NICU) في مستشفى أبو الريش؛ كلية الطب؛ جامعة القاهرة تعاني من ضائقة في الجهاز التنفسي، وتحديد التلاميذ ونقص التوتر. ظهرت الأعراض بعد رش المنزل بالمبيدات الحشرية. يبدو أن مستوى الكولينستيراز الكاذب للبلازما منخفض، بما يتوافق مع التسمم الحاد بمبيد الحشرات الفوسفات العضوي.

تتكون إدارة التسمم بالفوسفات العضوي من إدارة مجرى الهواء، وإدارة الأكسجين والسوائل، وكذلك الأتروبين بجرعات متزايدة وأوبيدوكسيم (معاد تنشيط أستيل كولين إستراز). تحليل Plasma pseudocholinesterase هو قياس رخيص وسهل لحشرات الفوسفات العضوي