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CASE REPORT

Ibraheem M. Rasheedat
Sanusi Ibraheem
Akanbi O. Peace
Emerhor Eseoghene
Gobir A. Aishatu

Meperfluthrin poisoning from mosquito repellent fumes in a 14-year-old Nigerian male adolescent- a case report

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Rasheedat M. Ibraheem, (✉)
Aishatu A. Gobir
Department of Paediatrics & Child Health, University of Ilorin and University of Ilorin Teaching Hospital, PMB 1515, Ilorin, Kwara State, Nigeria
Email:
rasheedahbidmus@yahoo.com

Ibraheem Sanusi, Peace O. Akanbi, Eseoghene Emerhor
Department of Paediatrics & Child Health, University of Ilorin Teaching Hospital, Ilorin, Kwara State, Nigeria

Abstract: Mosquito coils, common in resource-constraint countries where mosquito-borne diseases are endemic, are slow-burning sticks that emit smoke containing mosquito repellents, commonly pyrethroids like meperfluthrin. In humans, the documented side effects of inhaled meperfluthrin are few. We report a case of meperfluthrin toxicity following exposure to mosquito coil fumes.

A 14-year-old male adolescent developed multiple episodes of vomiting, respiratory distress, and altered consciousness following exposure to mosquito-repellent fumes containing 0.25% meperfluthrin. He had slept on a floor mat with the burning coil 20cm from his face before the onset of symptoms. He received initial oxygen, steroids, and antibiotics care at a private hospital before being referred to the teaching hospital. At presentation, his Glasgow Coma Score was 12, otherwise normal CNS finding. He developed irrational talk, violent behaviour and insomnia three days later. He recovered fully with supportive care. Excessive inhalation of meperfluthrinfumes maylead to neurotoxicity and pulmonary toxicity.

Keywords: Meperfluthrin; mosquito coil; inhalational poisoning; children; Nigeria

Introduction

Mosquito-borne diseases, like malaria, pose a significant global health challenge as the recent climate change coupled with the increasing world population makes mosquitoes a great threat to human health.[1] In 2020, the World Health Organisation (WHO) reported a malaria incidence of 241 million globally, with a mortality of 627 000.[2] Malaria is endemic in Nigeria, accounting for 60% of outpatient visits, 30% of childhood mortality, and 11% of maternal deaths.[3]

Vector control reduces vector and human contact by using insecticide-treated mosquito nets, wearing protective clothing, or using mosquito repellents like body sprays or coils.[4] Combustible coils usage is the preferred method of mosquito control in low-income communities because it is cheaper, easy to use, and readily available.[5] Burning the mosquito coil emits the active ingredient in the incense, repelling the mosquitoes. The main active ingredient of these coils is pyrethroid compounds, extracted initially from dried pyrethrum (*Chrysanthemum cineraria folium*) flowers.[6] However, it is now synthetically produced from pyrethroid esters, including d-allethrin, prallethrin, transfluthrin, and meperfluthrin.[6] Meperfluthrin,a fluorine-containing insecticide, has increasingly been used to make liquid mosquito repellents because of its low toxicity and high efficiency.[5,7] Poisoning from pyrethroid compounds can occur when exposure occurs via either inhalation, oral, dermal or ocular routes.[8] These have been documented in adults to cause acute or chronic manifestations.[7,8] We report a case of acute poisoning presenting with pulmonary and neurologic symptoms in a 14-year-old adolescent.

Case Report

A 14-year-old male adolescent was referred to the teaching hospital from a private facility because of altered consciousness following exposure to mosquito coil fumes overnight. He was apparently well before he went to bed at about 10.30 pm but was met in his vomitus in the morning at about 5.00 am with an altered level of consciousness. Vomitus contained ingested meal, was non-bilious and non-bloody, with a witnessed projectile episode but there were no repeat episodes of vomiting thereafter; no fever, diarrhoea or abdominal distension. He had altered consciousness but no other CNS symptoms. He had difficulty breathing that had resolved before presentation to the teaching hospital—no preceding history of medication or herbal preparation usage.

He slept on the mat without a pillow, with the combusting coil placed in about 20cm proximal to his hea on the floor in an enclosed room. There was a report of vomiting in a younger sibling who slept in the same room but

approximately two metres away from his sibling. No prior history of this mosquito coilbrand usage, purchased from a roadside hawker at 100 naira per stick. The active ingredient in the coil was 0.25% meperfluthrin (Figure 1). Previous mosquito coils used was placed by the father in the rooms, with the coil burnt prior to entering the room to sleep.

The child received parenteral antibiotics and steroids at the referring centre but was referred to the teaching hospital two days after admission on parental request despite the resolution of the difficulty breathing. At presentation, he had an altered level of consciousness with a Glasgow Coma Score of 12(eyes opening-3, verbal response-4, motor response-5). He was not in respiratory distress, not pale, anicteric, not cyanosed, not dehydrated, and a febrile.

Other central nervous system (CNS) findings were: pupils reactive to light and 3mm diameter size, no signs of meningeal irritation or cranial nerve deficit, with normal tone and reflexes. His respiratory rate was24 breaths / min, and his oxygen saturation by pulse oximetery in room air was 96%. Other respiratory and systemic examination findings were normal. Electrolyte, urea and creatinine and random plasma glucose values were within normal range while the Full blood count result showed elevated monocyte levels (Table 1).

Table 1: Investigation results

Parameter	Result	Unit	Reference Value
Electrolyte, Urea & Creatinine			
Sodium	141	mmol/L	135 – 145
Potassium	3.8	mmol/L	2.9 – 5.0
Urea	3.5	mmol/L	2.5 – 6.5
Creatinine	62	µmol/L	53 – 106
Full bloud count			
White blood cell count	$4.23x10^9$	per L	2.50 – 10.00
Neutrophil count	$2.06 x10^9$	per L	1.25 – 5.75
Lymphocyte count	$1.33 x10^9$	per L	0.65 – 3.75
Monocyte count	$0.71 x10^9$ ↑	per L	0.03 – 0.61
Eosinophil count	$0.12 x10^9$	per L	0.02 – 0.80
Basophil count	$0.01 x10^9$	per L	0.00 – 0.10
Neutrophil %	48.6	%	45.0 – 55.0
Lymphocyte %	31.4	%	25.0 – 40.0
Monocyte %	16.9 ↑	%	1.0 – 6.0
Eosinophil %	2.9	%	1.0 – 8.0
Basophil %	0.2	%	0.0 – 1.0
HCT	39.5	%	40.0 – 50.0
MCV	78.4	fL	76.0 – 96.0
MCH	27.3	Pg	27.0 – 32.0
MCHC	34.8	g/dl	32.0 – 36.0
Platelet count	$269 x10^9$	per L	100 – 450
Randomblood glucose	4.9	mmol/L	<11.1
RDT for malaria	Negative	-	-

HCT-haematocrit, MCV-mean corpuscular volume, MCH-mean corposcule haemoglobin; MCHC- mean corposcule haemoglobin concentration, RDT-rapid diagnostic test

A diagnosis of meperfluthrin toxicity was made, and intravenous fluid commenced with close vital signs monitoring. On the third day post-admission, he developed irrational talk and behaviour, with insomnia hence sedated with IV diazepam six hourly. By the seventh day on admission, he was fully conscious, well-oriented, with no residual neurologic deficit. He had no fever or any other new symptoms while on admission and was discharged home for clinic follow-up. During a follow-up visit, all examination findings were normal.

The managing team informed the hospital's Pharmacovigilance department and subsequently the National Agency for Food and Drug Administration (NAFDAC). The NAFDAC's feedback was to monitor for attendant risks associated with the coil and to ensure the manufacturer provided clear instructions on usage.

Fig 1: The frontal (A) and lateral (B) views of the mosquito repellent packet showing the active ingredient as 0.25% meperfluthrin and the instructions for usage.

Discussion

Pyrethroid compounds, like meperfluthrin, are the common active ingredients in most combustible mosquito repellents used in high-burden malaria countries.[8] These compounds are less hazardous than insecticides like Dichlorodiphenyltrichloroethane (DDT) previously used but have some health implications in inappropriate exposure cases, principally from inhalation or ingestion.[7,8] The index case had CNS manifestations of altered consciousness, irrational talk and behaviour, and insomnia following mosquito fumes inhalation. He was in a poorly ventilated room, with close facial proximity to the fumes, for about six hours.

Pyrethroids act mainly on the sodium channel by keeping it open for a long duration, causing CNS hyperexcitability and resulting in seizures.[9] As sodium channels are also present in type I and type II pneumocytes, pyrethroids may destroy the permeation gradient leading to airway and bronchial mucosal oedema. The index case did not have seizures. Inhalational poisoning presents mainly with respiratory symptoms like sore throat, runny nose, red eyes and even difficulty breathing. It causes airway mucosal damage and hypersensitivity.[9] Our patient majorly had both respiratory and neurologic manifestations following inhalational exposure. However, respiratory difficulty resolved within two days. The early resolution of respiratory symptoms are likely related to the weight of the child and the timely administration of steroids. His weight probably allowed for a wider distribution per kilogram body weight of the substance, and the prompt steroid given was beneficial in reducing the inflammation.

In China, reports of accidental meperfluthrin ingestion in toddlers were associated with severe dyspnoea, cough, fever and seizures.[7,10] Chest computed Tomography (CT) showed features of consolidation, atelectasis, and multiple striated exudates.[7,10] The cranial CT findings for the child with seizures were normal, but the brain Magnetic Resonance Imaging showed high signal intensity beside the anterior horn of the right lateral ventricle.[7] No radiological or toxicological investigations were carried out in the index case due to parental financial constraints and lack of toxicological screening in the hospital. Diagnosis may initially be difficult without eliciting the history of mosquito coil usage or accidental exposure. Still, in the index case, a history of mosquito coil fume exposure elicited enabled a temporal association of cause. Although the household often uses mosquito coil repellent, the particular brand, in this case, was used for the first time. Moreover, this was the first time the repellent hadn't burnt fully before sleep time, with placement done by the affected patient instead of the father..The product's proximity to the child's face and inadequate ventilation, might have contributed to the toxicity. Confirmation of diagnosis is via assessing for merperfluthrin metabolites in blood or urine samples.[10] However, we were unable to check for meperfluthrin metabolites due to lack of diagnostic capabilities for assessing drug metabolite levels in our facilty as well as the cost implication.

Treatment of meperfluthrinpoisoning is mainly supportive, targeted at the life-threatening complications. However, the use of steroids to reduce inflammation has been beneficial.[9] With acute toxicity, the prognosis is good, with complete recovery.[10] Our patient has been stable since discharge.

Conclusion

In conclusion, inappropriate, excessive exposure to mosquito coil fumescan cause pulmonary and neurologic manifestations. Clear instruction leaflets on mosquito coil usage to the public are imperative.

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