Characteristics of endosulfan poisoning: a study of 23 cases

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ABSTRACT

Introduction: Organochloride insecticides are chlorinated cyclic hydrocarbons having molecular weights in the range of 300-550 Da. Case series of endosulfan poisoning are extremely rare in the literature. We report 23 cases of endosulfan poisoning.

Methods: This retrospective study enrolled patients with endosulfan poisoning presenting to our emergency department from January to December 2005. The data were collected from clinical records and laboratory files.

Results: On admission, initial symptoms were nausea and vomiting in 17 patients (73.9 percent), seizures in five patients (21.7 percent), and dizziness in one patient (4.3 percent). Symptoms began within one hour after ingestion in 12 patients (52.2 percent), in the second hour in nine patients (39.1 percent), and in the third hour in two patients (8.7 percent). Seizure types were generalised tonic-clonic in 16 patients (84.2 percent), and focal seizures in three patients (15.8 percent). 19 patients were observed for one day, two patients were observed for two days, and one patient was followed-up for ten days in the emergency department. One patient was transferred for liver transplantation on the fifth day to another centre. All patients were treated symptomatically by intravenous diazepam for controlling seizures.

Conclusion: Endosulfan poisoning can be suspected in the presence of primary central nervous system manifestations including seizures, with or without clinical or laboratory evidence of other organ dysfunction such as liver failure.

Keywords: central nervous system disorders, endosulfan poisoning, insecticide ingestion, organochloride insecticide, poisoning

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INTRODUCTION

Organochloride insecticides are chlorinated cyclic hydrocarbons that have molecular weights in the range of 300-550 Da[1]. They have a long half-life in the human body, and cause moderate toxicity[2,3]. One of such insecticides is endosulfan (6,7,8,9,10-10 hexachloro 1,5,5a,6,9,9a-hexahydro-6-methano-2,4,3-hexadithioxanthiepin 3-oxide), which has been widely used in agriculture since 1960[4]. The uncontrolled use of these compounds in developing countries have resulted in the deaths of animals and humans[3]. There are isolated case reports of accidental and suicidal poisoning with endosulfan in the literature[4]. Case series of endosulfan poisoning are extremely rare in the literature. We report 23 cases of endosulfan poisoning.

METHODS

This retrospective study enrolled patients presenting with endosulfan poisoning to the Hospital of Ondokuz Mayıs University from January to December 2005. Clinical diagnosis of the patients had been based on the history, and patients' examination findings. All patients' blood samples had been sent to Ankara Refik Saydam Poisoning Centre for toxicologic screening. All patients were observed in the emergency department of our hospital by specialists in emergency medicine. If patients needed advanced treatment, they were sent either to other services or the intensive care unit. In our emergency department, there are the rooms for emergency care, observation, and polyclinic care. Most rooms have bedside monitors.

The data were collected from the emergency department medical records and included clinical characteristics such as nausea, vomiting, diarrhoea, stomachache, respiratory distress, seizures, pulmonary oedema, agitation, headaches, dizziness, body temperature, blood pressure, pulse rate, respiratory rate, biochemical parameters (blood urea, serum creatinine, serum electrolytes, liver function tests, serum bilirubin levels), and complete blood count

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(CBC). In all patients, laboratory parameters were repeated. In addition to general emergency management (including intravenous fluids, gastric lavage and activated charcoal), intravenous diazepam was also administered for controlling seizures. The data were processed using the Statistical Package for Social Sciences (SPSS) version 13.0 (Chicago, IL, USA). The Kruskal-Wallis test was used to compare the age groups for the frequency of epileptic seizures. For all statistical analyses, a p-value of 0.05 or less was considered to be statistically significant.

RESULTS

Of all patients, 78.3 % (n=18) were male. Mean age was 29.7 (range 14 to 65) years. Initial symptoms were nausea and vomiting in 17 patients (73.9%), seizures in five patients (21.7%), and dizziness in one patient (4.3%). At presentation, nausea and vomiting were present in 21 patients (91.3%), seizures was present in 19 patients (82.6%), dizziness was present in four patients (17.4%), and diarrhoea was present in one patient (4.3%). Nausea and vomiting continued for six hours and then patients recovered spontaneously. The demographical and clinical characteristics of the cases are shown in Table I. Symptoms had began within one hour after ingestion in 12 patients (52.2%), in the second hour in nine patients (39.1%), and in the third hour in two patients (8.7%). Seizure types were generalised tonic-clonic in 16 patients (69.6%), and focal motor in three patients (13%). 19 patients were observed for one day, two patients were observed for two days, and one patient was observed for ten days in the emergency department. 22 patients were discharged with complete recovery. One patient was transferred for liver transplantation on the fifth day to another centre, but he was later discharged with a complete recovery without the need for liver transplantation. There was no difference among the age groups for the frequency of epileptic seizures.

CBC, blood sugar, urea, creatinine and electrolytes were normal. On day two, measurements were repeated and all values were normal except for liver function tests in the form of aspartate aminotransferase (AST) (322 U/L, 224 U/L, 1,754 U/L) and alanine aminotransferase (ALT) (114 U/L, 132 U/L, 334 U/L), which were abnormal in three patients. In two of these, symptoms had begun within one hour after ingestion (first symptoms were nausea-vomiting in case one and seizures in case two), and the values of AST or ALT returned to normal at the end of the third and the tenth day, respectively. In case two, nausea and vomiting did not develop. In case three, symptoms had begun at the second hour after ingestion (first symptom was nausea and vomiting), and AST and ALT had increased gradually. Then the patient developed hepatic ensephalopathy and was transferred for liver transplantation on the fifth day. Serum bilirubin levels were normal in all patients. The serum of all the patients were positive for endosulfan. However, endosulfan levels could not be measured.

Table I. The demographical and clinical characteristics of the cases.

Characteristics	n	(%)
Age (years)		
≤17	4	17.4
18-44	15	65.2
45-65	3	13
≥65	1	4.3
Gender		
Male	18	78.3
Female	5	21.7
Mechanism		
Ingestion	23	100
Others*	-	-
Aetiology		
Accidental	23	100
Suicidal	-	-
Clinical		
CNS		
Seizure		
GTC	16	69.6
Focal motor	3	13
Agitation	1	4.3
Dizziness	4	17.4
Signs of meningial irritation	-	-
Lateralising sings	-	-
Abnormal-sized pupil	-	-
General		
Nausea	21	91.3
Vomiting	21	91.3
Diarrhoea	1	4.3
Hypotension	-	-
Hypertension	-	-
Jaundice	-	-

* Inhalation, injection, skin contamination

GTC: Generalised tonic-clonic

CNS: Central nervous system

DISCUSSION

Endosulfan is a polychlorinated hydrocarbon pesticide used in agriculture. Acute toxicity may result in permanent neurological impairment[5]. The predominant toxicological effect is over-stimulation of the central nervous system (CNS), by inhibiting

Ca- and Mg-ATPase and antagonising chloride ion transport in gamma-aminobutyric acid (GABA) receptors with little or no peripheral component[1]. Characteristic clinical signs following acute exposure are indicative of CNS disturbances or overstimulation. These signs include seizures, nausea, vomiting, abdominal discomfort, hyperaesthesia of the mouth and face, tongue and extremities, headaches, agitation, hyperactivity, incoordination, confusion, dizziness, and myoclonus[1,3,6]. Convulsions are a common and severe manifestation[7]. Diarrhoea is an unusual symptom, which was observed in one of our cases. The same symptom was also reported by Singh et al[7].

In our study, nausea, vomiting and abdominal pain had been observed predominantly in up to two-thirds of the cases, and these symptoms continued for six hours and then patients recovered spontaneously. Endosulfan is also toxic to the liver, kidney and lung, and can cause rhabdomyolysis in higher doses[8]. Liver function tests in the form of AST or ALT could be abnormal[8]. In our study, there were increased levels of AST and ALT in three patients. AST or ALT levels had been lowered with supporting treatment in two of these patients; however one case had been transferred for liver transplantation. There was no correlation with nausea, vomiting and liver function abnormality. Severe poisoning may result in death due to status epilepticus that can lead to asphyxia[3,8]. None of our cases developed status epilepticus.

Hypoxia may also be secondary to aspiration of vomitus or respiratory failure[1]. The toxic effects generally seem to be completely reversible; hence, it is necessary to identify the poison and spare no effort to resuscitate the patient[8]. Except for one case which develop liver function abnormality, in all of the other cases, the toxic effects were completely reversible. Gas chromatography can detect endosulfan in the serum, tissue, and urine[3]. Although a clinical diagnosis depends on a detailed history and suspicion, it may be necessary to measure concentrations of endosulfan for legal purposes[9,10]. All of our cases had a history of exposure to endosulfan and the diagnosis was also confirmed by laboratory examination for endosulfan.

In addition to general management, it has been reported that activated charcoal can be administered, although its ability to bind various organochlorines has never been adequately studied[1,3]. However, it has been reported that haemoperfusion is ineffective[9]. Seizures should be controlled with benzodiazepine, followed by phenobarbital if seizures persist. Phenytoin is probably less effective in these cases, given the effect of endosulfan on GABA receptors[1,3]. Sood et al[11] reported a case of with endosulfan poisoning presenting with status epilepticus. Their case had a complete recovery with symptomatic treatment. In the present study, seizures were controlled with benzodiazepine, and none of the patients developed status epilepticus. It has been reported that in endosulfan poisoning, seizures are observed for a period of 30 minutes to six hours[4]. In our study, seizures were seen within the first three hours in all affected patients.

Pulmonary toxicity associated with endosulfan poisoning has been reported as an important manifestation[8]. We did not encounter pulmonary oedema in our cases. In our study, predominant symptoms due to endosulfan poisoning are due to the involvement of the CNS. Endosulfan poisoning should be suspected in the presence of primary CNS manifestations, with or without clinical or laboratory evidence of other organ dysfunctions such as liver failure. There was no difference among the age groups for the frequency of epileptic seizures. Endosulfan poisoning is often completely reversible with the appropriate management.

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