

# REVIEW ARTICLE

## KEROSENE POISONING IN CHILDREN: AN OVERVIEW

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**INTRODUCTION:** Poisoning due to drugs is influenced to a large extent by the population's socioeconomic and cultural status.<sup>1</sup> In developing countries, acute poisoning is a major preventable public health problem among children.<sup>2</sup> Kerosene ingestion is one of the most common causes in these settings<sup>3,4,5</sup> and is a significant cause of morbidity and mortality<sup>6,7,8</sup> Although this problem has mostly been eliminated in the developed countries, many developing countries are still lagging behind.<sup>8</sup>

Kerosene is a hydrocarbon, got by distillation and purification of crude petroleum or rock oil. It is predominantly used in rural and semi-urban areas for cooking, heating and lighting. However, it is often stored in containers and places, which are easily accessible to children.<sup>9</sup> This problem is further complicated by inquisitive and explorative nature of children.<sup>5</sup> Carelessness of parents in storing kerosene is a major concern: it is usually stored in unlabelled containers and within the child's reach.<sup>10</sup>

**EPIDEMIOLOGY:** Many studies have shown that kerosene ingestion is one of the most common causes of poisoning in children. In a recent study from Nepal, it has been observed that kerosene poisoning was more common in young children, while organophosphorus poisoning was in adolescents.<sup>5</sup> Children below five years are especially vulnerable for acute poisoning.<sup>5</sup>

In an Indian study, kerosene aspiration contributed to 60.4% of poisoning cases. There was a predominance of male gender, and those from a rural background.<sup>7</sup> However, in a Malian study, kerosene poisoning accounted for 11.1% of all poisoning cases reported in children less than 6 years (Average 1.8±1.1 years). Similar to the Indian study, over half of the cases (57.1%) were males with a male-female ratio of 1.3.<sup>2</sup> Similarly, a study in Zimbabwe showed that 11.8% of paediatric poisoning admissions were due to kerosene, and the median age was 2 years.<sup>11</sup> In Nigeria, kerosene poisoning constituted 1.2% of all paediatric admissions (not limited to only poisoning cases). About 62% of the cases were less than 2 years, similar to other studies.<sup>6</sup> Abu-Ekteish demonstrated that in Jordan, 90% of cases were <4 years of age.<sup>12</sup>

**CLINICAL FEATURES:** Early recognition and management is quintessential to prevent the life threatening complications of kerosene poisoning.<sup>9</sup>

Ingestion of kerosene per se does not cause any significant problem, because it is poorly absorbed by the gastrointestinal tract. However, aspiration into the respiratory tract often occurs at the time of ingestion when coughing and gagging are common, and especially if the child vomits.<sup>9,10</sup> In several studies, it has been observed that cough and dyspnea were the commonest clinical presentations.<sup>6,9</sup> Others features noted were fever, vomiting and central nervous system involvement.<sup>1,6,12</sup>

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Even when 1 mL of kerosene is ingested, there can be significant pulmonary complications, while more than 10 ml could be fatal.<sup>9</sup> The pulmonary complications of kerosene can be severe because the low viscosity of the latter increases penetration into more distal airways and its low surface tension causes it to spread over large areas of the lung.<sup>9</sup>

Kerosene aspiration can cause severe pneumonitis with resultant pulmonary oedema and hypoxemia. The child usually presents with cough, dyspnoea and sometimes fever >40°C. Tachypnoea, tachycardia, cyanosis, pulmonary crepitations and rhonchi (Observed in over 75% of patients) are the frequent clinical signs, observed on examination.<sup>7,10,13</sup>

These findings strongly support that small air way obstruction is the major pulmonary complication caused by kerosene aspiration.<sup>13</sup> Caution needs to be exercised, as these clinical features can be misleading: sometime, even in the absence of any signs or symptoms, pulmonary changes like non-segmental consolidation or collapse, predominantly the lower lobes and right side have been observed radiographically.<sup>10</sup> Other pulmonary radiograph findings include a varied spectrum of changes, pleural effusions and pneumatocoeles being frequent observations.<sup>13</sup>

Involvement of the CNS has been observed is about 25% of cases.<sup>10</sup> Of note is that all patients with CNS signs and symptoms had severe pulmonary involvement. This implies that the severity of pulmonary involvement and development of neurological complications are closely related and directly proportional. Hypoxia because of pulmonary involvement is responsible for the CNS complications, rather than the direct effects of kerosene itself.<sup>13</sup> The frequent presentations are lethargy and drowsiness, or restlessness, while occasionally, stupor, convulsions and coma have also been observed.<sup>1,10</sup>

Other less frequent clinical features are cardiac dysrhythmias like atrial fibrillation and ventricular fibrillation, hepatic and renal failure. Additionally, on contact with the skin and mucous membranes, kerosene causes irritation, which can even result in bullae formation. Rarely, bone marrow toxicity and haemolysis have also been observed.<sup>10</sup>

In cases where the child is initially examined in a primary care facility, the presence of wheezing, any alteration in consciousness (Lethargy or any Restlessness), or a rapid respiratory rate for age ( $\geq 50/\text{min}$  if age <12 months,  $\geq 40/\text{min}$  if age  $\geq 12$  months) at presentation needs attention and intensive care.<sup>4</sup>

**MANAGEMENT:** The first step is to remove the child from the source of poisoning and make sure that the airway is patent. Then, contaminated clothing is removed, followed by a thorough cleaning of the skin with soap and water. Some children may require intubation and mechanical ventilation, especially in cases of severe hypoxia, respiratory distress or altered consciousness. It is crucial to keep the patient nil orally. Charcoal and gastric lavage is strictly contraindicated, because they carry the risk of inhalation and therefore, pneumonitis.

In case of consumption of a large quantity of kerosene less than an hour prior to presentation, then lavage can be done, provided the airways are protected by expert intubation.<sup>10,14</sup>

In case the subject is asymptomatic, he/she has to be observed for 6 hours, and can be discharged if no symptoms occur. However, the patient has to be followed up the next day. If the patient has respiratory symptoms, chest radiography and pulse oximetry are done on priority.

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Oxygen is administered in order to maintain saturation >94%. There is no specific antidote, and the management is symptomatic. Antibiotics are often prescribed to prevent any infection, complicating the condition. However, there is no evidence that corticosteroids have any place in management.<sup>10,14</sup>

**PREVENTION:** Prevention is the cornerstone of overcoming this menace of kerosene poisoning. Most cases occur because of negligence by the parents or the guardians. Adequate care is not taken to prevent exposure of the child to harmful substances. Additionally, kerosene is used often for cooking in rural and semi-urban areas; by people belonging to low socioeconomic status.<sup>9</sup>

It is stored in places easily accessible to children like under stairs, kitchen and bathroom.

The main containers used are soft drink bottles, water jugs and water glasses.<sup>12</sup> The natural inquisitiveness of the child further adds to the problem.<sup>5</sup> Further, because of inadequate legislation on the sale of kerosene, it is often sold in unlabelled containers.<sup>15</sup>

Parents and guardians should be counselled and educated about proper storage of kerosene and other potentially hazardous substances, keeping them out of reach to children.<sup>5</sup>

The government should enforce strict policies to sell kerosene in child-proof containers, and implement health education policies for parents/guardians.<sup>5,16</sup> Additionally, steps should be taken to enhance the standard of living of people in the rural and semi-urban areas, in order to reduce the use of this hazardous chemical.<sup>6</sup>

**SUMMARY AND CONCLUSION:** Kerosene poisoning is a major problem in the developing countries, especially affecting children less than five years of age. It is highly lethal, with even ingestion of as less as 10 mL causing deaths. The problem is further compounded by the absence of a specific antidote, with symptomatic management being the only option. Therefore, prevention is the best way to avert this issue. The Government has to take a lead role in enforcing strict policies on the sale of kerosene and health education of parents/guardians.

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