



Kerosene—a toddler's sin: A five years study at tertiary care hospital in western India



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ABSTRACT

Acute kerosene poisoning is a preventable health problem in children perceived mainly in developing countries. It influences socioeconomic and cultural status of country due to its contribution in morbidity and mortality. As kerosene is widely used as household energy source in India at rural areas as well as urban, it accounts for significant number of poisoning cases mainly accidental in manner. As there are only handful studies from India on kerosene poisoning in children, we planned this study to evaluate incidence of kerosene poisoning in Western Indian population and its clinico-epidemiotoxicological profile. In this retrospective cross-sectional study, we collected data of all the cases of kerosene poisoning diagnosed during five years from 2009 to 2013 at Shri Krishna hospital situated at Karamsad, Gujarat state of Western India. We observed among total 42 cases, all victims were under 3 years of age. Evening in summer months, rural areas, storage of kerosene in household containers, inadequate parental supervision and door-to-hospitalization period emerged as most serious associated factors. Fever, cough, vomiting, tachypnoea and leucocytosis were commonest manifestations while pneumonia was the most common complication. Signs of central nervous system involvement, leucocytosis and vomiting were significantly correlated with pneumonia. Deaths occurred due to pneumonia. Early diagnosis and treatment of pneumonia may reduce mortality and recommendations are made to reduce the incidence of kerosene poisoning.

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1. Introduction

Kerosene is a mixture of different hydrocarbons like aliphatic, aromatic, cyclo-paraffins and alkenes in relative amount which vary from one region to another. The American Association of Poison Control Centre (AAPCC) noted that kerosene was accounted for 5% of deaths attributed to hydrocarbon poisoning annually.¹ About 60% of these exposures involved children. Hydrocarbons accounted for 18% of all paediatric admissions for poisoning.¹ 90% of hydrocarbon related deaths involved children less than 5 years of age.¹ Kerosene was the cause in 59% cases of acute poisoning admitted to the Ga Rankuwa Hospital, South Africa in 1982–85, 74% of which involved children aged 1–3 years and 26% of which died.² Kerosene is the leading cause of childhood poisonings in many

countries like India, Kuwait, Nigeria, Bangladesh, Jordan, Nepal, etc., where it accounts for up to 16% of all paediatric poisoning cases.^{3–8} This involves mainly children between 1 and 3 years of age.^{3–8} This age group would be referred as a toddler which means a young child who is just beginning to walk.

As per National Crime Records Bureau, Ministry of Home Affairs, Government of India, total number of accidental deaths due to poisoning registered in India during the year 2014 was 20587 which was 4.55% of all accidental deaths.⁹ Kerosene is widely used as a source of energy for cooking and lighting purposes in India. NSS [National Sample Survey] Report of 68th round (July 2011–June 2012) by NSS Office, Ministry of Statistics and Programme Implementation, Government of India stated that currently 27.3% of rural homes, and a minuscule 3.2% of urban ones, use kerosene for lighting purposes.¹⁰ During the same period, percentage of households using kerosene for lighting in rural India was as high as 73.5% in Bihar, 58.5% in Uttar Pradesh, 43.3% in Assam, 36.8% in Jharkhand, 32.3% in Odisha and 29.3% in West Bengal.¹⁰ A 5.7% and 1% of the households in the urban and rural areas of India respectively used kerosene as primary source of energy for cooking.¹⁰ National

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Poisons Information Centre in Delhi, India reported unsafe storage of kerosene in the home is one of the most common causes of toxic exposure in the Delhi region.¹¹ It is a common practice in rural areas is that the traders buy kerosene in bulk and then sell it in small amounts to individuals who bring their own containers, usually, used soft drink bottles. As toddlers develop hand-to-mouth activity and become more mobile, they are more prone to accidental consumption of kerosene from used soft drink bottles. They remain at risk until about the age of five or six years, because of their innate curiosity, lack of judgement and inability to read.¹¹

Kerosene constitutes 5–15 carbon atoms per molecule with low volatility and low viscosity. Substances with lower viscosity SSU <60 (Saybolt seconds universal) and lower surface tension are associated with higher tendency for aspiration. Co-operative Kerosene Poisoning study (COKP) proportionately correlated the amount of ingested kerosene with pulmonary and central nervous system complications.¹ Kerosene predominantly affects pulmonary system along with central nervous, gastro-intestinal, cardiac and dermatologic systems. It has been demonstrated that intra-tracheal instillation of small amount (0.2 mL/kg) of kerosene causes a decrease in compliance and total lung capacity with pathologic changes such as interstitial inflammation, polymorphonuclear exudation, intra-alveolar haemorrhage, edema, hyperemic blood vessels, bronchiolar necrosis and vascular thrombosis. It would mostly be due to a combination of direct toxicity to pulmonary tissue and a disruption of the lipid surfactant layer.¹

Only handful literature could be found on studies pertaining to the incidence of kerosene poisoning in India predominantly in toddlers and its clinical profiles. Many researchers around the world have found the factors associated with kerosene poisoning such as age group, household storage containers, summer season and evening period of day.^{4–8} Therefore, the present study was undertaken to obtain data among population presenting at a tertiary care centre in Western India about known variables, any new associated variables; and a correlation, if any, with the clinical findings. So, the present study was planned to document clinico-epidemiological profile of kerosene poisoning using indicators such as age, sex, residence of rural or urban region, source of kerosene, place, manner, season, day-time of poisoning, door-to-hospitalization period, etc. which could be a good source for initiating preventive measures, raising community awareness and to minimize magnitude of problem.

2. Materials and methods

In the present retrospective study, medical records for cases of kerosene poisoning presenting to Shri Krishna Hospital, a tertiary care centre associated with medical college situated at Anand district, Gujarat state of Western India during year 2009–2013 were studied. All the cases with alleged history and diagnosis of kerosene poisoning were included in research protocol. Laboratory investigations, radiological examinations, autopsy reports and chemical analysis reports were taken into consideration. All observations were registered in the standardised prevalidated proforma and analysed using Microsoft® Excel 2010 [trial version] and STATA® [available with the institute].

3. Results

During the 5 years study period, a total of 42 cases were diagnosed of kerosene poisoning. As depicted in Fig. 1 which is showing factors associated with kerosene poisoning, all the cases pertained to children less than 3 years of age which accounted to 90% of the poisoning cases in children of same age in the same period. 22 toddlers had age less than 1 year, 15 had age between 1 and 2 years

while rest 5 had age between 2 and 3 years. Amongst them, 30 were male and 12 were females. Male female ratio was 1:0.4.37 toddlers (88.10%) belonged to Hindu religion and 5 toddlers to Islam. 35 toddlers (83.33%) belonged to rural areas and 7 toddlers to urban areas. In all cases, place of accidental ingestion of kerosene was at home. The source of kerosene was known in only 18 cases (42.86%) which revealed that kerosene was stored at home in either soft drink bottles or in household containers. Data about the amount of kerosene ingested was not available. With regards to season, Fig. 2 shows that 33 cases (78.58%) occurred in summer (March–June), 5 cases occurred in winter (November–February) and 4 cases occurred in monsoon (July–October). In 30 cases (71.43%) time of ingestion of kerosene was in evening between 4 p.m. and 8 p.m., in 7 cases it was in night between 8 p.m. and 4 a.m. and in 5 cases it was in morning and noon between 4 a.m. and 4 p.m.

With regards to clinical signs and symptoms as noted in table- 1, fever in 40 cases (95.23%), cough in 39 cases (92.86%), vomiting in 35 cases (83.34%), tachypnoea in 37 cases (88.09%) and smell of kerosene from mouth was perceived in all 42 cases. In 28 cases (66.67%) laboratory investigation revealed leucocytosis (predominantly eosinophils and neutrophils). Out of 35 toddlers (83.34%) having undergone radiological examination, evidence of pneumonia was confirmed in 30 cases (71.43%). Increased bronchio-vascular markings and pneumonitis were evident. Right lung and lower lobe of lungs were most common affected sites. Statistical findings as mentioned in table- 1 shows that vomiting was significantly correlated with pneumonia after ingestion of kerosene (p value < 0.05). Positive correlation of leucocytosis was seen with pneumonia (p value < 0.05). Signs of central nervous system involvement like drowsiness, restlessness, stupor and convulsions were evident in 25 cases (59.53%) and they were positively correlated with pneumonia (p value < 0.05). In 4 cases signs of central nervous system were present without evidence of pneumonia.

As noted in Table 1; during hospitalization period, 34 (80.95%) cases were treated with supplemental oxygen, 35 cases (83.34%) with antipyretics, 34 cases (80.95%) with antibiotics and 8 toddlers (19.05%) had been shifted to PICU (paediatric intensive care unit) for mechanical ventilation. The average hospitalization stay was 3 days. Gastric lavage was not performed in any case. 3 toddlers died due to aspiration pneumonia with mortality rate being 7.14%. All 3 toddlers who died belong to rural areas and an average door to hospitalization period in these cases is 6.25 h which was more than that in other cases. 26 cases (61.90%) were presented to hospital within 3 h of ingestion and 16 cases were presented within 6 h.

4. Discussion

Toddlers are a vulnerable group for accidentally ingested kerosene due to lack of cognitive, psychological and psychomotor skills and undifferentiated senses of smell and taste as reported in similar studies.^{3–8} As mentioned by Shotor and Anwar et al. and noted in the present study, evening time (4 p.m.–8 p.m.) in summer season had higher incidence of kerosene poisoning probably because in summer season increase in temperature creates urge for thirst, so dehydrated children would eagerly drink the fluid they easily access.^{6,7} All the cases occurred accidentally at home which is comprehended by keeping the age of victims in mind. Majority of cases belong to Hindu religion due to the considerable size of the population belong to it. Inadequate parental supervision, easily accessible storage of kerosene and placement of container may be the possible underlying reasons. In Sri Lanka, kerosene oil containers in homes were said to be hardly ever stoppered.¹² In Malaysia, children in 70% of cases had ingested kerosene from soft drink containers.¹³ An investigation of storage of paraffin in homes in villages in South Africa found that most households had a paraffin container

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