

## Hydrocarbon poisoning in children: 1-year retrospective study

Sachin S Hatti, Vinod Uplaonkar, Charanraj Honnalli

From Department of Pediatrics, Khaja Banda Nawaz Institute of Medical Sciences, Kalaburagi, Karnataka, India

**Correspondence to:** Dr. Vinod Uplaonkar, Department of Pediatrics, Khaja Banda Nawaz Institute of Medical Sciences, Kalaburagi, Karnataka, India. Phone: +91-9019224559. E-mail: vinsadoc@gmail.com

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### ABSTRACT

**Context:** Accidental hydrocarbon poisoning continues to be a major problem in children in India. **Objectives:** The objectives of the study were to study the demographics, clinico-laboratory profile of hydrocarbon poisoning in children admitted to our hospital from April 2015 to March 2016. **Secondary Objective:** The secondary objective of the study was to determine correlation between vomiting and development of pneumonia after hydrocarbon consumption. **Materials and Methods:** In this retrospective descriptive study, all children with the history of hydrocarbon consumption and admitted to the hospital during the study period were included in the study. The medical records of these children were reviewed retrospectively, data were recorded in a standard pro forma and were analyzed. Chi-square test was used for comparing differences between categorical variables. For interpretation of results, significance was adopted at  $p < 0.05$  at 95% confidence interval. **Results:** A total of 52 cases (thinner-15 and kerosene-37) were included in our study. Male: Female ratio was 1.4:1, with the mean age in years being  $3.01 \pm 2$ . Most of them belonged to upper lower socioeconomic status (SES) and rural areas, 48 (92%) and 30 (57%), respectively. Most cases were seen in summer season 20 (38.3%). 14 children (23%) were asymptomatic, and 38 (77%) were symptomatic. Vomiting 35 (67.3%) was the most common symptom followed by cough 24 (46%) and fever 15 (28.8%). Four (7.9%) had altered sensorium and 2 (3.5%) had convulsions. Respiratory distress was seen in 30 (57.6%), tachycardia in 22 (42.3%), hypoxia in 21 (40.3%), 4 (7.6%) had wheeze, and 18 (34.6%) had crackles. The mean duration of stay in hospital was  $\pm 40$  h. The outcome was good, the improvement was seen with 48 (92.3%) and 4 left against advice. **Conclusions:** Most common age group was 1–3 years, with most of them, belonged to upper lower SES and rural background. Respiratory distress was the most common system involved followed by the central nervous system. Chemical pneumonitis was the only complication with the good outcome.

**Key words:** Chemical pneumonia, Children, Hydrocarbon, Poisoning

Poisoning is a qualitative term used to define the potential of a chemical substance in acting adversely or deleteriously on the body [1-4]. Hydrocarbon ingestions account for about 5% of all accidental poisonings and 25% of all fatal ingestions in children of <5 years of age [1,5]. Kerosene is a hydrocarbon product of petroleum distillate, made up of paraffin and naphthalenes. In developing countries kerosene is commonly kept in the home, being extensively used for cooking, heating, and lighting. Consequently, accidental kerosene ingestion is often seen in children in these countries. Kerosene toxicity involves mainly the respiratory and central nervous systems (CNS). The gastrointestinal tract is also commonly but mildly involved. Rarely, other systems may be affected such as the liver, kidneys, and myocardium [6]. The aim of our study was to evaluate the demographics, clinico-laboratory profile and outcome of hydrocarbon poisoning in children.

### MATERIALS AND METHODS

A retrospective descriptive study was conducted among children of 0–12 years of age, admitted to a medical college of Gulbarga

(Karnataka). The study was conducted from April 2015 to March 2016 (12 months) after getting approval from the Institutional Ethic Committee. All children in the age group of 0–12 years with the history of any accidental hydrocarbon consumption were included in the study after taking consent from the parents or legal guardians. Children with pneumonia, on treatment at the time of consumption of hydrocarbon and children with seizure disorder (epilepsy), were excluded from the study.

The medical records of these children were reviewed retrospectively, data were recorded in a standard pro forma which included the following details: Demographics, history clinical sign and symptoms, and chest radiographic findings which were taken minimum after 6 h of hydrocarbon consumption, complete hemogram taken after 24 h of hydrocarbon consumption, complications involving any organ system such as pneumonitis, convulsion and outcome with respective to improvement, and duration of stay in hospital.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) software version 22.0 (SPSS, IBM Inc. New York). For quantitative data mean and standard deviation

were calculated. Chi-square test was used for comparing differences between categorical variables. For interpretation of results, significance was adopted at  $p < 0.05$  at 95% confidence interval.

## RESULTS

A total of 52 cases were reviewed, constituting 6.5% of total admissions for the year in our hospital. The most common type of hydrocarbon consumed was kerosene 37 (71.1%), followed by thinner 15 (28.9 %). The mean age of presentation was  $3.01 \pm 2$  years. Most cases were there in summer 20 (38.3%) followed by rainy 18 (34.6%) and winter 16 (27.1%) season, respectively. Table 1 show the baseline and demographic characters of the study population.

A total of 38 children (76.07%) were symptomatic at the time of presentation, with most common presentation being vomiting 35 (67.3%), followed by hurried breathing 30 (57%), cough 24 (46%), fever 15 (28.8%), altered sensorium 4 (7.9%), and convulsion 2 (3.5%) in the decreasing frequency. Clinically, tachypnea and retractions 30 (57.6%), tachycardia 22 (42.3%), low saturation 21 (40.3%), crackles 18 (34.6%), and wheeze 4 (7.6%) were seen.

A significant correlation ( $p=0.0058$ ) between vomiting immediately after consumption of hydrocarbon and development of pneumonia was found with 18 (34.6%) children developing pneumonia out of 35 (67.3%) children presenting with vomiting. Similarly, a significant correlation ( $p=0.011$ ) was found between hypoxia and development of CNS complaints with 4 (7.9%) developing altered sensorium out of 21 (40.3%) with hypoxia. Prior intervention before admissions such as gastric lavage and inducing vomiting was significantly associated ( $p=0.0001$ ) with the development of pneumonia (Table 2).

Leukocytosis significantly correlates with development of chemical pneumonitis with  $p$ -value being significant 0.00002 ( $< 0.05$ ). The outcome was good in most cases 48 (92.2%), with 4 (7.8%) leaving against medical advice, none requiring mechanical ventilation. The mean duration of stay in hospital was  $40 \pm 4$  h.

## DISCUSSION

Physicochemical properties of hydrocarbons, such as high volatility, low viscosity, and low surface tension, result in aspiration and also result in pulmonary injury. Lower viscosity promotes penetration into more distal airways and lower surface tension increases spread over a larger area of lung tissue [7]. In our study, the mean age was  $3.01 \pm 2$  years with 1–3 years being the most common age group and male:female ratio of 1.4:1. Curiosity and lack of awareness are mainly attributed to the involvement of toddler age group (1–3 years) [1,3,8].

In our study, most cases were from rural and urban slums. Kerosene is a common household commodity, especially in rural areas [2,3]. Parental supervision is often lacking; therefore, these children are at high risk for kerosene poisoning. A significantly

**Table 1: Baseline and demographic characters of the study population**

Parameters	n (%)
Age (in years)	
<1	0
1–3	42 (80.7)
3–6	8 (50.3)
6–12	2 (3.8)
Sex	
Male	30 (57.6)
Female	22 (42.3)
Residence	
Rural	30 (57.6)
Urban slums	12 (23)
Urban	10 (19.2)
SES	
High	0
Upper middle	0
Lower middle	4 (7.9)
Upper lower	30 (57.6)
Lower	18 (34.5)

SES: Socioeconomic status

**Table 2: Correlation between prior intervention before admission and development of pneumonia**

Prior intervention	Pneumonia		Total
	Yes	No	
Done	8	0	8
Not done	12	32	44
Total	20	32	52

Chi-square value=15.12, P=0.0001

larger number of cases of hydrocarbon poisoning occurred in summer than in winter, or rainy season in the present study. During hot seasons, the child is likely to be thirsty and may mistake kerosene (or another hydrocarbon) for water or another cold drink [4]. Vomiting was the most common symptom in our study 35 (67.3%) attributed to mucosal irritation [9].

There was a significant correlation between vomiting and development of pneumonitis ( $p=0.0058$ ) in the present study. It is suggested that vomiting after kerosene ingestion may cause aspiration can lead to pulmonary pathologies [10-13]. In our study, there was a significant correlation between children with a prior intervention such as gastric lavage and inducing vomiting with the development of pneumonia. Furthermore, similar to other investigators [14,15], we found a high prevalence of symptoms relating to the respiratory system as most common.

It is widely accepted that hypoxia is the cause of CNS symptoms in cases of kerosene poisoning. In our study, all children with CNS symptoms had desaturation on presentation ( $p=0.011$ ) [16]. In our study, there was a significant correlation between leukocytosis and pneumonia similar to other studies ( $p=0.00002$ ). A variety of radiological abnormalities have been reported after hydrocarbon ingestion, including pneumonitis, pleural effusion,

pneumothorax, pneumomediastinum, subcutaneous emphysema, and pneumopericardium [17-19], but in our study bilateral interstitial pneumonia was the most common followed by right basal pneumonitis.

Medical care was mainly supportive. Patients received antipyretics, intravenous fluids and electrolytes, and humidified oxygen when necessary. Antibiotics were prescribed when supportive treatment proved insufficient and secondary bacterial infection was suspected. There was no mortality in our series. Educational programs are needed in rural areas, and slums to educate people and health-care workers about the do and don'ts related to hydrocarbon poisoning such as avoiding induction of vomiting and gastric lavage.

The main limitations of the study were that in this study, the data were collected retrospectively and are therefore subject to errors of omission or incomplete documentation.

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