

## Kerosene Poisoning In Children

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### ABSTRACT:

#### BACKGROUND:

Accidental kerosene ingestion is the commonest cause of poisoning and its subsequent mortality and morbidity in children less than five year of age in developing countries. Low socio- economic status and frequent use of kerosene for cooking, lighting and heating are the major cause.

#### OBJECTIVES:

To study the epidemiology, presentations and radiological appearance of kerosene poisoning in children.

#### METHODS:

A prospective study comprised fifty patients, who were admitted with accidental kerosene poisoning into children welfare hospital in medical city complex /Baghdad. In the period from the 1<sup>st</sup> of January to the 31<sup>st</sup> of august 2008. History was taken from the relatives on a specially designed questionnaire. Every patient was examined completely concentrating on symptoms of cough, dyspnea, cyanosis, drowsiness, vomiting, and fever. Chest X-ray was done to every patient after 6-8 hours from the time of ingestion. White blood cell count was done to 39 patients within the 1<sup>st</sup> 24 hour of admission. Fisher's exact test was considered for the statistical analysis with a significance level of  $P < 0.05$ .

#### RESULTS:

Of the fifty admitted children, 86% of them aged between 1-3 years, 31(62%) were boys, the majority from poor and crowded families, and the kerosene ingested, in the majority, from small containers. The most common presentations were cough (96%), fever (94%) and dyspnea (80%). Vomiting which occurred in 90%, had a significant association with the development of pneumonitis the major radiological abnormality was right lower lobe infiltration in 16 patients (32%). The major complication was pneumothorax, pleural effusion and respiratory failure. Fever appeared in 94% of the patients in the first 24 hours, lasting 2-7 days. Pneumonitis occurred in 42 patients who were diagnosed clinically and radiologically. All patients improved except one who died.

#### CONCLUSION:

All the kerosene poisoning was accidental, occurred in children under five year of age. Ignorance and poor storage of kerosene played a big role in the kerosene ingestion process. The respiratory system is the main target involved. Vomiting playing a role in the development of pneumonitis.

**KEY WORDS:** kerosene, hydrocarbon, children, pneumonitis, vomiting.

### INTRODUCTION:

Accidental kerosene ingestion is the commonest cause of poisoning and its subsequent mortality and morbidity in children less than five year of age in developing countries. Low socio- economic status and frequent use of kerosene for cooking, lighting and heating are the major cause.<sup>(1,2)</sup> Ingestion usually occurs in young children as a result of the ready availability of kerosene stored in various household utensils Kerosene and other hydrocarbon toxicities; gasoline, benzene, lighter

fluid, furniture polishes, household cleanser and propellants affect mainly the respiratory and central nervous system.<sup>(3,4)</sup> kerosene is poorly absorbed after ingestion but absorption is rapid after inhalation or pulmonary aspiration.<sup>(4)</sup>

The toxic potential of kerosene is directly related to their physical properties which include high volatility, low viscosity, and low surface tension.<sup>(5)</sup> Low viscosity enhances penetration into more distal airways, and low surface tension facilitate spread over a large area of lung tissue.<sup>(6)</sup> Experimental toxicological studies have shown that aspirated, but not the ingested, kerosene affects the respiratory system.<sup>(6)</sup> Kerosene is easily aspirated when present in vomitus owing to its surface

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tension, which facilitates rapid spread over the surface of contact.<sup>(3)</sup> In general, kerosene has a bad taste, therefore large volumes are rarely ingested. However, it is reported that children rarely consume more than (30) ml.<sup>(7)</sup> Ingestion of more than 30 ml of hydrocarbon is associated with increased risk for severe pneumonitis.<sup>(8)</sup> Ingestion of even less than (1ml) of kerosene is significantly related to pulmonary complications.<sup>(2,3)</sup> Signs and symptoms of respiratory involvement usually begin within 30 minutes after aspiration and may progress during the first 24-48 hr and then subside in the following one -two weeks.<sup>(9)</sup> Complications include: hypoxia, pneumonitis, bacterial pneumonia, pneumatocele, pleural effusion, pneumothorax, subcutaneous emphysema and empyema.<sup>(2,9,10)</sup> Pneumatocele usually appear late, with a range of 2-21 days.<sup>(5)</sup> Most of the hydrocarbons have anesthetic properties and can cause transient CNS depression.<sup>(5)</sup> Seizures are believed to be due to hypoxia. Fever and direct CNS hydrocarbon toxic effect may also play a role in the pathogenesis of CNS involvement.<sup>(11, 12)</sup> The usual gastro-intestinal manifestation of kerosene ingestion is abdominal pain, nausea, vomiting, diarrhea, and constipation. Dysarrhythmias are major concern. Renal tubular acidosis, renal failure and toxic nephropathy can occur.<sup>(13, 14)</sup> Aromatic hydrocarbon can cause bone marrow suppression and skeletal muscle damage.<sup>(13)</sup> Kerosene causes burning in the mouth and throat, choking and gagging, coughing, nausea, vomiting.<sup>(11)</sup> Tachypnea, nasal flaring, retraction, grunting, cyanosis, rales and wheezes are the pulmonary symptoms. Weakness, dizziness, lethargy, mental confusion, irritability, agitation, convulsion and coma are the neurological manifestations.<sup>(11)</sup> Abdominal pain, vomiting, nausea, diarrhea, constipation, hepatitis and acute hepatic failure are gastrointestinal manifestations. Sudden death due to myocardial irritability and ventricular fibrillation may occur following ingestion.<sup>(13)</sup> Fever (38 -40°C) due to body reaction to foreign substance which occur within hours after ingestion for as long as 10 days.<sup>(3,4)</sup> Roentgenographic findings may show minimal changes a few hours after ingestion but may progress rapidly after that with extensive infiltrate.<sup>(15)</sup> Common findings include fine perihilar opacities, bi-basilar infiltrates and atelectasis which may coalesce to produce a picture of consolidation.<sup>(4)</sup> Chest radiographs may remain abnormal long after a patient is clinically normal and should not be used to guide acute treatment. In

most cases radiological changes resolved completely within 10-14 days.<sup>(10)</sup> Accompanying leukocytosis may be misleading because, in most cases of aspiration pneumonitis, no bacteria are present in the lungs.<sup>(3)</sup>

#### **PATIENTS AND METHODS:**

Fifty children admitted to Children Welfare Teaching Hospital (CWTH) in Baghdad after kerosene ingestion during the period from the 1<sup>st</sup> of January to the 31<sup>st</sup> of August 2008, were studied prospectively. All the children were admitted to the emergency unit at least six hours for observation. History was taken from the relatives on a specially designed questionnaire including: Age, sex, family size, mother's occupation, socioeconomic status, and the source of ingested kerosene whether from small containers (cups, Bottles, Jugs, etc....) or directly from the barrel. Every case was studied concentrating on symptoms of cough, dyspnea, cyanosis, drowsiness, vomiting, and fever. Chest X-ray was done to every patient after 6-8 hours from the time of ingestion. White blood cell count was done to 39 patients within 1<sup>st</sup> 24 hour of admission. A White blood cell count of more than 15000 cell/mm<sup>3</sup> considered to be leucocytosis according to the age group. Daily follow up for these patients carried on and their temperature, clinical course and complications during hospitalization were evaluated. Fisher's exact test was considered for the statistical analysis with a significance level of  $P < 0.05$ .

#### **RESULTS:**

Of the fifty admitted children, 31(62%) were boys and 19(38%) were girls with M:F ratio 1.5:1, with ages ranging from 1-5 years ( median =2.5 year ). Most cases, 41 (82%) were from urban areas, who were considered from poor 31(62%) and large sized families 30(60%) Nearly all patients` mothers were housewives 48(96%). The kerosene ingested from small containers (small cans, soft drink bottles, kettles and drinking glasses) in 48 (96%) cases (Table 1). Signs and symptoms of kerosene poisoning are presented in table 2. The most common findings were cough, fever, vomiting and dyspnea which occurred in 48 (96%), 47(94%), 45(90%) and 40 (80%) patients respectively. Other clinical features including:Grunting 26(52%), cyanosis 18(36%), Drowsiness 21(42%), convulsions 2(4%), one due to high temperature, the second one had had no high temperature, abdominal pain 6(12%) and diarrhea 4(8%) patients which occurred early, soon after ingestion with negative stool exam. Radiological abnormalities

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that appeared six hours after ingestion including: right lower lobe infiltrate in 16 patients (32%), bilateral lower zones infiltration in 13 patients (26%) and bilateral perihilar infiltrate in 8 patients (16%).(Table 3) Vomiting was found to have a significant association with the development of pneumonitis P= 0.024 (Table 4). White blood cell count were done to 39(78%), in 31(79.5%) of them the counts ranged between 5000-15000 cell /mm<sup>3</sup> and 8(20.5%) patients in range of >15000 - 20000 cells /mm<sup>3</sup>, which has no significant association with the development of pneumonitis. P= 0.16. All 50 children were hospitalized in pediatrics ward with duration of hospitalization ranged from 2-7 days. Forty three patients (86%) developed pneumonitis, which was treated by oxygen, intravenous fluid and antibiotics. Seven patients (14%) had normal chest radiography which been discharged after a period of observation. Antibiotics were ordered by the consultant in charge from the first day of admission

and these included: 14 patients (28%) with cefotaxime sodium (claforan) and ampiclox (ampicillin + cloxacillin), 14 patients (28%) with claforan alone and 20 patients (40%) with ampiclox alone only 2 patients (4%) did not receive antibiotics.

Fever developed in 47 patients (94%), ranging between 38-40.5°C, with a duration from 2-7days. Forty two (84%) of the admitted patients obtained oxygen therapy for respiratory distress. Two patients (4%) had convulsion, one of them had high fever. Two patients (4%), developed right sided pleural effusion 3 days after admission, treated conservatively and only one patient (2%) had right sided pneumothorax necessitating chest tube insertion. All the admitted patients with kerosene poisoning survived and were discharged in good condition except one( 2%) who died shortly after arrival to the hospital, who was in severe respiratory distress due to massive aspiration .

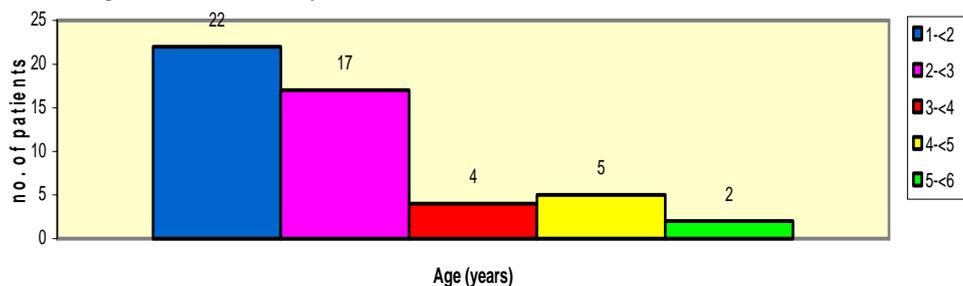


Figure 1: Age distribution of 50 patients with kerosene poisoning.

Table 1: Frequency distribution of demographic characteristics of 50 children admitted to CWTH with kerosene poisoning.

Characters		No. patients	%patients
Sex	Male	31	62
	Female	19	38
Age	1-3 years	43	86
	>3 years	7	14
Residence	Rural	9	18
	Urban	41	82
Socioeconomic status	Poor	31	62
	Good	19	38
Mother occupation	Housewife	48	96
	Employee	2	4
Family size	6+	30	60
	<6	20	40
Source of kerosene	Small containers	48	96
	Barrel	2	4

**Table 2: Frequency distribution of symptoms and signs of 50 children admitted to CWTH with kerosene poisoning.**

Signs and symptoms	No. Patients	% patients
Cough	48	96
Fever	47	94
Vomiting	45	90
Dyspnea	40	80
Grunting	26	52
Drowsiness	21	42
Cyanosis	18	36
Abdominal pain	6	12
Diarrhea	4	8
Convulsion	2	4

**Table 3: Frequency distribution of chest radiographic findings among 50 patients with kerosene ingestion.**

Radiological findings	No. patients	% patients
Right lower lobe infiltration	16	32
Bilateral lower lobe infiltration	13	26
Bilateral peri-hilar infiltration	8	16
Normal	7	14
Right mid lobe infiltration	4	8
Left lower lobe infiltration	2	4
Total	50	100

**Table 4 : Association of vomiting and the development of pneumonitis**

	pneumonitis	No pneumonitis	Total
Vomiting	40	5	45
No vomiting	2	3	5
Total	42	8	50

P=0.024

**DISCUSSION:**

Accidental kerosene ingestion remains a serious contributor to childhood poisoning in Iraq and other developing countries with subsequent morbidity and mortality. In this study , 31 patients (62%) were boys which agree with Nagi<sup>(16)</sup> study (63%)Shotar<sup>(17)</sup> study (60.6%) and Lifshitz<sup>(18)</sup> study (61%) .This is mostly because boys are more curious and active than girls of the same age. Parental supervision often was lacking which agree with other studies,<sup>(16,17,18)</sup> although 48 (96%) of the affected children's mother were housewives, but these children were at higher risk for kerosene poisoning, this is because these mothers were busy

with routine house work or caring for an other child, this was found also in Nouri L. and Al-rahim study <sup>(19)</sup> (85%) and Zaubas study<sup>(20)</sup> (93.75%). Forty-three patients (86%) were between 1-3 year of age, which agree with the results of Nouri L. and Al-rahim (94%), Shotar (80%), Lifshitz (92%) and Zaubas (73%). Which support the fact that poisoning is more common in such age group. In this study 60% of children were from poor and crowded families which agree with other studies,<sup>(16,17,18,19,20)</sup> which give evidence that poverty and crowding are important risk factors in kerosene poisoning because these children will

receive less attention and the families tend to use kerosene for lighting and cooking. Forty-one (82%) of the study patients were urban in parallel to Zauba study. Kerosene was ingested from small container in 48 patients (96%) which is similar to other studies<sup>(16, 17,18,19,20)</sup>.

That means, improper storage of kerosene in familiar drinking utensils is a risk for kerosene poisoning. Cough was present in 48 patients (96%), it was found in (83.5%) in Nagi study, (85.9%) in Zauba study and (67%) in Shotar study. Dyspnea was noticed in 40 patients (80%), also noticed in (86%) in Majeed study<sup>(14)</sup> (73.7%) in Lifshitz study and (79.7%) in Zauba study. Fever occurred in 47 patients (94%), which was (94%) in Majeed study, (73.8%) in Nagi study and (50 %) in Zauba study.

Cyanosis occurred in (36%) of patients while it occurred in (29%) in Nouri L. and Al-rahim study, and (14%) in Zauba study. Drowsiness occurred in 21 patients (42%), fourteen patients (66.7%) of them were cyanosed at presentation and subsequently proved to have pulmonary involvement which indicate that hypoxia is probably responsible for drowsiness rather than the direct toxic effect of kerosene on the central nervous system, a result similar to that stated by other studies.<sup>(17, 18,20)</sup> Vomiting after ingestion occurred in 45 patients (90%) of this study. Nagi reported vomiting in (60.6%), Zauba in (64%) while lifshitz in (51%).It was correlated with pneumonitis (P=0.024), this result agree with other studies<sup>(17, 18, 19,20)</sup>. In contrast to our finding Dudin et al<sup>(21)</sup> did not find an increased risk of respiratory complications related to vomiting after kerosene ingestion. Diarrhea occurred in 4 patients (8%) which is similar to Nagi finding (10%), abdominal pain in 6 patients (12%) which is similar to Zauba study (15%).

The radiological findings was mainly right lower lobe consolidation (32%), which agree with Nagi study (45%), Nouri L. and Al-rahim study (40%) and Zauba study (40.6%). The most frequent complication in this study was pleural effusion which occurred in right side in two patients(4%) and resolved spontaneously, which is also the most common complication in Nagi study (2%), Jayashree study<sup>(1)</sup> 4%, Nouri L. and Al-rahim study (2%) and Zauba study (4.5%).

One patient (2%) developed pneumothorax, necessitating chest tube insertion. which is found in jayashree study (2%) and Lifshitz study in one patient. Leucocytosis occurred in 8 patients (20.5%) of the 39 patients, and have no significance correlation in the development of pneumonitis (P=0.16), this result does not agree

with other studies<sup>(1,16,17,18,19)</sup> who showed a significant correlation, this might be due to a technical or human errors. Medical care was supportive, patients received intravenous fluid, antipyretics, humidified oxygen. Although, the role of antibiotics in kerosene pneumonitis is denied by the majority of authors,<sup>(15,16,22,23)</sup>but most of the patients received different types of antibiotics.

Although the mortality rate from kerosene ingestion is low, but it was reported. Only one patient (2%) from the study group died. Gubta et al<sup>(2)</sup> reported a (4.3%) mortality rate, Lucas<sup>(24)</sup> recorded 3 deaths in his study of 526 patients (0.57%) and Ellis et al<sup>(25)</sup> also reported a low mortality rate (0.74%).

#### **CONCLUSION:**

1. Most kerosene poisoning was accidental and occurred in the under 5 year age group.
2. Ignorance and bad storage of kerosene plays a big role in the process of ingestion of kerosene.
3. The respiratory system is the main target organ affected.
4. Vomiting after kerosene ingestion is related to the rate of development of pneumonitis.

#### **RECOMMENDATIONS:**

- 1- It is necessary to enlighten the public especially parents and care givers on the need for proper storage of kerosene containers keeping it away from the reach of children.
- 2- Also, it is important to inform the people through medias and primary health centers not to induce vomiting after kerosene ingestion.
- 3- Complications develop quickly therefore; it is imperative that medical practitioners familiarize themselves with the presentations of kerosene poisoning so as institute early and proper management.
- 4- Antibiotics should not used routinely as a prophylaxis unless secondary bacterial infection is suspected.

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