

KEROSENE POISONING IN CHILDREN WITH SPECIAL REFERENCE TO LUNG COMPLICATION

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Kerosene is distilled from petroleum at temperatures between 175 and 275 C. It contains saturated, unsaturated and aromatic hydrocarbons, and is used in heating, lighting and in jet and diesel engines. For this reason, it can be found in many places both indoors and outdoors. In the home, kerosene is kept in a variety of containers, such as coca cola bottles, unmarked jars, and milk bottles. As a result, children may drink kerosene without immediately realizing what they are drinking. According to a report from the United States, every year 400,000 children under the age of five ingest kerosene to a degree necessitating attention from physicians and hospitals.¹ Jacobziner reported that 25 per cent of fatal poisonings of children under the age of five are due to kerosene or petrolatum distillate poisoning.²

During the period from 1958 through the first six months of 1965, 142 children were seen in Hacettepe Children's Hospital because of kerosene or petrolatum distillate poisoning. Of the 142 children, two died, and 34 were hospitalized. Total hospitalization time for the 34 patients was 81 days and 13 hours, with a mean of two and a half days. Since we could find no reports from Turkey on the problem of kerosene poisoning, it was decided to review these cases, with special attention to the treatment given.

Results

Of the 142 patients analyzed after kerosene ingestion, 120 developed complications. Most of the patients were in the one to two year age group, followed in number by the two to three year old group. Two patients died; one within six hours and one within three hours of ingestion. Analyses of the patients revealed that stomach washing does not have any significant effect on the frequency or severity of lung complications. Our observations suggest that vom-

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ting is the major cause of lung complications, perhaps because patients aspirate small amounts of kerosene while vomiting.

Discussion

Foley reports that in 101 kerosene poisoning cases studied, the mean hospitalization period was 2.95 days, with two per cent fatality.³ Reed, et al, found death rates as high as 9.2 per cent in a group of kerosene poisoning cases.⁴

There has been little agreement among authors as to whether one of the main complications, lung infiltration, is caused by absorption of kerosene from the gastrointestinal tract or aspiration or inhalation of the chemical into the respiratory system.

Several investigators have used animal experiments to find the degree of toxicity of kerosene. Gerarde put 30 cc of kerosene (by intubation) into the stomachs of chickens, but recorded no obvious ill effects.⁵ He also showed that one cc of kerosene, when given through an intratracheal tube, caused generalized damage to the lungs. The same author also worked with rabbits and rats and found that no pulmonary lesions were caused if the kerosene was placed directly into the gastrointestinal system by intragastric tube. He gave 44 consecutive doses of kerosene to rats and reported no ill effects. However, he noted that some of the rabbits died when the original catheter was replaced by narrower ones. He concluded that aspiration took place at this point. Deichmann reported that 28 cc/Kg of kerosene is fatal to rabbits when given intragastrically.⁶ Lesser did control studies on rabbits, giving six rabbits 20 to 40 cc of kerosene by gastric tube, directly into the stomach. Six control rabbits were given 0.75 to 2.0 cc intratracheally.⁷ He observed that there were no ill effects on those who were given intragastric doses, but lung edema and lung damage occurred in the other group of rabbits who were given kerosene intratracheally.

Since 1932 there has been no agreement on whether stomach washing should or should not be carried out for those who have ingested kerosene and there is still no definite decision as to the best method of handling these patients. In this study we analyzed the cases of patients who were brought to Hacettepe Hospital with a history of kerosene ingestion. We have differentiated clearly the ages of the patients, and have tried to relate spontaneous vomiting, induced vomiting and stomach pumping to the course of the illness and the complications which arose. Table 1 gives a breakdown of

TABLE 1

AGE AND SEX OF THE 142 PATIENTS WHO INGESTED KEROSENE

Age (years)	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11
Number of patients	3	85	35	6	5	5	1	1	0	0	1
Per cent	2.8	59.8	23.88	4	3.5	3.5	0.7	0.7	—	—	0.7
Total intoxication	female		48	33.8 %							
	male		94	66.2 %							

the patients according to age and sex. The one to two year age group is the largest, 59.8 per cent of the total group. When analyzed according to complications, the most common occurred in the respiratory system (45 per cent). Central nervous system and gastro-intestinal tract complications followed in frequency (Table 2).

TABLE 2

AGE STATUS OF PATIENTS AND SYSTEMS INVOLVED

Age	C.N.S.	Respiratory system	Tachycardia	Gastro-intestinal system
0-1	—	2	—	—
1-2	32	37	21	27
2-3	10	17	2	14
3-4	4	2	—	2
4-5	1	3	1	1
5-6	1	3	2	3
6-7				
7-8				
8-9				
9-10				
10-11				
Total	48 (33.8 %)	64 (45 %)	26 (18 %)	47 (33 %)

Forty-nine patients developed broncho-pneumonia (25 of these were confirmed by x-ray examination, and 24 were diagnosed on the basis of physical examination only). Table 3 gives an analysis of the lung complications encountered in our patients. Among the 47 cases of lung infiltration analyzed in Table 3, there are indicati-

ons that induced or spontaneous vomiting is one of the major causes of lung complications. Patients who vomited, whether their stomachs were washed or not, had 45 per cent of the lung complications in comparison to 10.28 per cent who had lung complications but no vomiting (Table 3). Twenty-nine per cent of the lung complications occurred among those patients whose stomachs were washed, whereas 38 per cent of these complications occurred among those whose stomachs had not been washed. Foley found that 69 per cent of his bronchopneumonia patients had vomited, whereas 31 per cent had not.³

TABLE 3
RELATION BETWEEN VOMITING AND LUNG COMPLICATIONS

Treatment - first aid before or on admission to the hospital	number of patients	total number	lung infiltration	total number	percentage of lung infiltrations
Spontaneous or induced vomiting - no gastric washing	24	42	12	19	45.2
Spontaneous or induced vomiting - gastric washing	18		7		
No spontaneous or induced vomiting - no gastric washing	42	100	13	28	28
No spontaneous or induced vomiting - gastric washing	58		15		

Lung complications : Lung lesions caused by kerosene poisoning show a typical image on x-rays, characterized by pericardial infiltration looking much like fluffs of cotton. If the infiltration is unilateral, it is found usually on the lower right section of the lung. Skarbek reported tension cysts of the lungs in a two and a half year old patient 15 days after kerosene poisoning.⁸ Behrer reported on a patient with mediastinal emphysema and pneumothorax, and Reed reported observing pleurisy in two cases, one of a two year old girl brought to the hospital four days after kerosene ingestion, whose x-ray showed unilateral pleurisy.^{9,4} The other patient was a two and a half year old boy who had bilateral bronchio-pneumonia after kerosene ingestion. Nine days after ingestion, control x-rays showed pleurisy. Behrer reported that 75 per cent of

the patients who had ingested kerosene showed lung infiltration when routine lung x-rays were taken.

Lesser reported 77 per cent and Reed 86 per cent of their patients developed lung infiltrations after kerosene ingestion."⁴

Lung infiltrations ordinarily develop very shortly after kerosene ingestion: within one half hour in one of our cases. Bonte, et al, obtained serial x-rays after giving kerosene to dogs intratracheally.¹⁰ They found that lung infiltration could be visualized radiologically within fifteen to twenty minutes after intratracheal administration of kerosene.

Reed did follow-up studies on 13 patients for periods of time ranging between six months and four years after kerosene ingestion. He obtained case histories, physical examinations and x-ray controls. All the patients were found to be without complications, except two : one complained of frequent colds, the other of failure to gain weight. None of the x-rays of these patients showed lung pathology.

As the central nervous system is more sensitive in young children than in adults, central nervous system complications are seen quite frequently in patients who have ingested kerosene. Forty-eight of our 142 patients (34.2 per cent) had major or minor central nervous system complications, ranging from lethargy to convulsions. McNally reported that 40 per cent of his patients had central nervous system complications.¹¹

In our series, 47 patients (33 per cent) developed gastrointestinal complications such as vomiting, nausea, or a burning sensation in the stomach, and in one case, gastrointestinal bleeding. Fifty-five percent of the patients had respiratory system symptoms, i.e., cough, tachypnea, cyanosis, dyspnea, etc. Two patients died after kerosene ingestion. One was a four year old boy who ingested two mouthfuls of kerosene and who was admitted to the hospital 42 hours later. He was pale, had respiratory difficulty and generalized convulsions. He died six hours after admission and no autopsy was performed. The second was a two year old boy who allegedly ingested 20 cc of kerosene and immediately developed a frothy secretion at the mouth and a respiratory grunt. He died three hours after admission. Autopsy showed congestion in the brain, lung edema, bleeding in the stomach, and cloudy swelling of the liver cells and the tubular epithelia of the kidneys.

Conclusion

Kerosene ingestion is seen quite frequently among children. Complications usually are observed in the cardiovascular, gastrointestinal and respiratory systems. Cardiovascular system involvement generally appears as tachycardia. The gastrointestinal symptoms usually cited are nausea, vomiting, and diarrhea. A large percentage of the patients show symptoms of drowsiness, and some of them may go into coma or convulsions. Respiratory system complications are caused by irritation of the respiratory system from the circulating kerosene in the blood. The taste of kerosene is not pleasant, and for this reason few patients ingest more than a few mouthfuls. However, even small amounts are enough to cause lung damage and even pulmonary edema when aspirated. We believe that it is unnecessary to wash the stomach routinely in those patients who have ingested only a few mouthfuls of kerosene, since intragastric tube placing may cause gagging and vomiting. However, if it is known that large amounts of kerosene have been ingested, gastric lavage should be carried out to prevent serious central nervous system complications.

Since kerosene poisoning occurs most frequently among young children, parents should be informed about the hazards of kerosene, and urged to keep it away from places where children can easily reach it in and about the house.

Summary

We have reviewed briefly the literature of kerosene poisoning and analyzed 142 cases of such poisoning seen at Hacettepe Children's Hospital. Our data suggested that induced or spontaneous vomiting is the major cause of lung complications and that stomach washing does not necessarily decrease the possibility of lung complications.

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