

Original Research Article

PREDICTION OF ILLNESS SEVERITY AND OUTCOME OF CHILDREN WITH KEROSENE INGESTION USING THE SCORING SYSTEM FOR HYDROCARBON POISONING

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ABSTRACT

Background: Objective: To predict the illness severity and outcome of children less than or equal to 12 years with kerosene ingestion admitted at Tirunelveli Medical College on admission using the Scoring System for Hydrocarbon poisoning.

Materials and Methods: This hospital based observational study was conducted among All children less than or equal to 12 years with history of kerosene oil ingestion admitted in Tirunelveli Medical college are evaluated with the scoring System for Hydrocarbon poisoning at the time of admission and serially every 2 hours upto 8 hours.

Results: Among the 40 total subjects 13 cases admitted in the hospital within 2 hours after kerosene ingestion. 20 subjects admitted in 2 to 3 hours and 7 subjects admitted after three hours of ingestion. Among the total 40 subjects 22 subjects developed no complications, 17 subjects developed Chemical pneumonitis and 1 subject needed ventilator support and subsequently died. Out of 40 subjects 39 subjects had absence of cyanosis (score 0) and one subject had cyanosis (Score 3). 19 subjects had SpO₂ >95% (Score 0), 20 subjects had SpO₂ 81% to 95% (score 1) and 1 subject had SpO₂ <60% (score 3). There was no subject with SpO₂ 61% to 80% (score 2). auscultatory findings 14 subjects had wheeze (score 1) and 26 subjects had crepitation and or diminished air entry (score 2).

Conclusion: The Scoring system for hydrocarbon poisoning can be applied bedside and is useful in assessing the clinical severity and outcome of children with kerosene poisoning.

Keywords: Illness Severity, Kerosene Ingestion, The Scoring System, Hydrocarbon Poisoning.

INTRODUCTION

Poisoning in children is the twelfth most common cause of admission in the paediatric ward.^[1] Kerosene poisoning constitutes 0.23 to 3.3% of total poisoning and the fatality rates range from 0.64 to 11.6%.^[2] In children below 5 years accidental poisoning is common and especially kerosene, a hydrocarbon is the commonest orally consumed poison in Indian children. Often the kerosene is inappropriately stored in drinking glasses, water bottles, soft drink containers. It may be attractive to children

Young children are at high risk for accidental ingestion because of their immature metabolic and respiratory system. They are more likely to ingest because of their undeveloped sense of smell and taste. They mistake kerosene for water or soft drinks believing it as a pleasant drink with which they are familiar.^[3,4]

Accidental ingestion of hydrocarbons in middle and low income countries are 50 times more common than high income countries because in low and middle income regions hydrocarbons are the extensively used for cooking, lighting and heating.^[5]

Signs of oral kerosene poisoning include diarrhoea, nausea and vomiting. Approximately 30 – 50% of children presenting with suspected kerosene ingestion are asymptomatic.^[6]

Children have survived ingestion of up to 1.7 g kg⁻¹ and recorded instances of fatal poisoning have been associated with doses ranging from ~ 2 to 17 g kg⁻¹^{7,8}. However, death following oral exposure is normally associated with aspiration of vomit rather than systemic toxicity per se. Vomiting occurs in approximately one third to one half of patients.

Kerosene easily aspirated during ingestion and mainly vomiting because of its low surface tension and rapidly spread over the surface of contact. This is particularly dangerous in young children, who form the bulk of patients, because of the relatively smaller surface area of the tracheo-bronchial tree.

Hence this study was conducted to predict the illness severity and outcome of children less than or equal to 12 years with kerosene ingestion admitted at Tirunelveli Medical College on admission using the Scoring System for Hydrocarbon poisoning.

MATERIALS AND METHODS

This hospital based observational study was conducted among All children less than or equal to 12 years with history of kerosene oil ingestion admitted in Tirunelveli Medical college are evaluated with the scoring System for Hydrocarbon poisoning at the time of admission and serially every 2 hours upto 8 hours. Duration of study was 18 months. The maximum score arrived is taken to assess the severity of outcome in the subjects. The development of chemical pneumonitis associated with kerosene ingestion takes upto 8 hours. So the

subjects are assessed with the scoring system every two hours upto 8 hours.

Inclusion Criteria

All children less than or equal to 12 years with history of kerosene oil ingestion admitted at Department of Paediatrics, Tirunelveli Medical College.

Exclusion Criteria

Children with mixed hydrocarbon ingestion or pure hydrocarbon ingestion other than Kerosene oil.

Children with known chronic respiratory illness.

Children with history of Central Nervous System, Cardiac or Renal diseases.

After written consent from the parents the subjects are included in the study.

Clinical examination is performed. Child was assessed for the following parameters

- Cyanosis
- SpO₂ level
- CNS (Conscious / Drowsiness / Coma responding to verbal or painful stimuli / Not responding to verbal or painful stimuli)
- Pulmonary involvement (No lung signs / Wheeze / Crepitation and or diminished air entry)
- Respiratory distress (Cough, tachypnea, usage of accessory muscle)

The Total Scoring Number (TSN) is obtained at the time of admission and every 2 hours upto 8 hours

X - Ray was taken after 8 hours and assessed for the development lung complications.

Child was followed up for the duration of stay in the hospital, development of lung complications and need of ventilator support.

The final outcome obtained in terms of duration of stay, development of lung complications or death.

Scoring system for Hydrocarbon poisoning

Parameter/ Score	0	1	2	3
Cyanosis	Absent			Present
SpO ₂ Level	>95%	81%-95%	61%-80%	Less than or equal to 60%
CNS	Fully conscious	Drowsiness	Coma responding to stimuli (Verbal or painful stimuli)	Deep coma (Not responding to verbal or painful stimuli)
Pulmonary involvement	Free chest	Wheezes	Crepitation and/or diminished air entry	
Respiratory distress	Absent	Cough	Cough & tachypnea	Cough, tachypnea and or accessory muscle use
Vomiting	Absent	Present		

Total scoring number (TSN)

- (TSN) 0-4: excellent prognosis.
- (TSN) 5-8: complete cure.
- (TSN) 9-11: chest complications (chemical pneumonitis).
- (TSN) 12-15: ICU, ventilator use and may be death (bad prognosis).

Statistical Analysis

The different parameters are assessed in relation to outcome. Age distribution, sex distribution, relation

between vomiting and total score. The final outcome is correlated with the final score attained. The result is assessed in terms of correlation coefficient.

RESULTS

40 subjects were included in the study. The following observation and results are obtained in the study group.

Age distribution

Although the study group can include children upto 12 years, maximum age of children in the study was 6 years. The age ranged from 1 year to 6 year with mean of two and half years and the standard distribution of 1.25 years. Among 40 subjects 29 children are boys and 11 are girls.

Out of 25 cases occurred over one year, 18 cases (72%) occurred during the summer months of April to September. 7 cases (28%) occurred during the months of October to March which come under monsoon and winter months. Residence of children divided into rural and urban. Out of total 40 subjects 7 were from urban areas and the remaining 33 from rural areas.

Vomiting is a major risk factor for the development of chemical pneumonitis as the risk of aspiration is high with vomiting. Among the 40 subjects 30 had vomiting. Among the 30 subjects who had vomiting, in 67% of subjects vomiting was induced by parents or care givers and the remaining 33% of subjects had spontaneous vomiting

Vomiting and development of complications

30 subjects had vomiting, out of which 18 subjects had developed complications in terms of chemical pneumonitis and death. There was no complications who didn't have vomiting.

Parent's education

Higher the qualification among the father and mother is taken for categorization. Parent's education is divided into four categories. Those studied upto 5thStandard are categorized to Primary school, 6thstandard to 8thstandard are categorized to middle school, 9thstandard to 10thstandard into High school and 11thand 12thstandard into Higher secondary school. There was no parents who are illiterate, graduates or diploma holders.

Parents of 45% of subjects were studied upto High school, 22.5% were completed primary schooling, 20% upto middle school and 12.5% were studied upto Higher Secondary.

Number of Siblings

The subjects were analysed in relation to number of siblings. 26 subjects had one sibling, 12 subjects had two siblings, 2 subjects had 3 siblings and there was no subjects with four or more siblings

Storage of kerosene

The kerosene poisoning occurred at home in all the 40 cases. Among the poisoning cases the purpose of kerosene at home and the container used to store the kerosene were elicited.

Among the 40 cases, kerosene used for cooking purpose in 26 cases (65%) and used for heating

water at home in the remaining 14 (35%) cases. In all cases the kerosene was stored in the kitchen.

The kerosene was stored in water bottles in 32 (80%) cases and in soft drink bottles in 8 cases (20%). In all cases the containers were placed in reachable places like on the floor or in the lower shelves of open cup-board.

Duration between Kerosene ingestion and hospitalization

Among the 40 total subjects 13 cases admitted in the hospital within 2 hours after kerosene ingestion. 20 subjects admitted in 2 to 3 hours and 7 subjects admitted after three hours of ingestion.

Duration between exposure and hospitalization ranged from half an hour to 13 hours with mean of two and half hours and standard deviation of two hours

The total number cases in each duration group is compared to number of cases who developed complications in terms of chemical pneumonitis and death.

It showed that those presented earlier were developed complications more in relation to those who presented late.

Complications developed

Complications of kerosene ingestion is analysed in terms of development of chemical pneumonitis with the X – Ray findings, ICU admissions, need of ventilator support and death.

Among the total 40 subjects 22 subjects developed no complications, 17 subjects developed Chemical pneumonitis and 1 subject needed ventilator support and subsequently died.

The subject who had died presented to the hospital 3 hours after ingestion and died within 3 hours of admission, i.e. within 6 hours after ingestion. That child was referred another hospital.

Scoring system for Hydrocarbon poisoning

Subjects were assessed by the scoring system for Hydrocarbon poisoning at the time of admission and then every two hours upto eight hours. The maximum score attained is taken for the study purpose.

Total score for the scoring system is 15. The total score is divided into 4 categories as Score 0 to 4, 5 to 8, 9 to 11 and 12 to 15.

The following observations obtained for the individual parameters of the Hydrocarbon poisoning score

Cyanosis

Out of 40 subjects 39 subjects had absence of cyanosis (score 0) and one subject had cyanosis (Score 3).

Table1: Cyanosis

Cyanosis (Score)	Number of cases	Percentage
0	39	97.5%
3	1	2.5%
Total	40	100%

SpO2 level

19 subjects had SpO2 >95% (Score 0), 20 subjects had SpO2 81% to 95% (score 1) and 1 subject had SpO2 <60% (score 3). There was no subject with SpO2 61% to 80% (score 2).

Table 2: SpO2

SpO2level (score)	Numberofcases	Percentage
0	19	47.5%
1	20	50%
2	0	0%
3	1	2.5%
Total	40	100%

CNS

Out of 40 subjects, 8 subjects had no disturbance in consciousness (score 0), 16 subjects had drowsiness (score 1), 13 subjects had coma responding to verbal and painful stimuli (score 2) and 3 subjects had deep coma (score 3).

Table 3: CNS

CNS (score)	Number of cases	Percentage
0	8	20%
1	16	40%
2	13	32.50%
3	3	7.50%
Total	40	100%

Pulmonary involvement

Based on the auscultatory findings 14 subjects had wheeze (score 1) and 26 subjects had crepitation and or diminished air entry (score 2).

Table 4: Pulmonary Involment

Pulmonary involvement (score)	Number of cases	Percentage
0	0	0%
1	14	35%
2	26	65%
Total	40	100%

Respiratory distress

Based on respiratory distress 2 subjects had only cough (score 1), 20 subjects had cough and tachypnea (score 2) and 18 subjects had cough, tachypnea and accessory muscle use (score 3)

Vomiting

Among 40 subjects, 30 subjects had history of vomiting following kerosene ingestion (score 1) and 10 subjects had no vomiting (score 0)

Distribution of score

The subjects are categorised into four groups. 8 subjects had score 0 to 4, 16 subjects had score 5 to 8, 15 subjects had score 9 to 11 and 1 subject had score 12 to 15

Complications developed

Complications were assessed in terms of development of chemical pneumonitis, ICU admission, ventilator support and death. Totally 17 subjects developed chemical pneumonitis and one subject needed ventilator support and subsequently died.

The number of complications in each category of score: There was no complication in 0 to 4 score category, 2 subjects developed chemical pneumonitis in score 5 to 8 category, 15 subjects developed chemical pneumonitis in score 9 to 11 category of which 2 subjects needed ICU treatment and one subject had died in the score 12 to 15 category.

Table 5: Complications

Score	Complications	Ventilator support
0 – 4	0	No
5 – 8	2	No
11-Sep	15	No
15-Dec	1	yes

11% of subjects who developed complication was in score 5 to 8 category, 83% of subjects who

developed complication was in score 9 to 11 category and 6% of subjects who developed complication was in score 12 to 15 category

Outcome distribution:

Outcome is assessed by the duration of In-patient treatment and death. The duration of hospital stay is divided into 4 categories as less than or equal to 3 days, 4 to 7 days and more than 7 days. The number of cases in each group is as below.

Table 6: Outcome Distribution

Duration of In-patient treatment	Number of cases
< 3 days	10
4 - 7 days	15
> 7 days	14
Death	1

The duration of In-patient (IP) treatment is each score category is given below

1. Score 0-4: The duration of IP treatment had ranged from 2 days to 3 days with mean of 3 days (corrected to full number without decimal)
2. Score 5-8: The duration of IP treatment had ranged from 4 days to 8 days with mean of 5 days
3. Score 9-11: The duration of IP treatment had ranged from 6 days to 11 days with mean of 9 days
4. Score 12-15: The one subject in this category had died in 3 hours of admission.

DISCUSSION

As discussed in the review of literature accidental poisoning of kerosene is common in children in developing countries like India. Based on the study the following inference were obtained.

The poisoning occurred mostly in young children with range of one year to 6 years with a mean of two and half years. 80% of children in the study were below 3 years of age.

The reason for this may be the immature development of olfactory functions in young children. They tend to easily attracted by the colour of the kerosene which is blue in colour in government subsidised supply which is the common source of kerosene for domestic usage in India. In all cases the kerosene was stored in water bottles or soft drink bottles and kept in reachable places at home, particularly in kitchen

The poisoning occurred in 72% of cases in summer months of April to September as the children gets thirsty often and tend to drink the kerosene thinking that it is a water or soft drinks because of the container used.

In 72% of cases the poisoning occurred in boys. The reason behind male preponderance may be the higher degree of hyperactivity behaviour among boys.^[9]

82% of children admitted with kerosene ingestion was from rural areas as the kerosene usage is more common in rural population compared to urban population. Kerosene is also used for initiation of fire while cooking with woods in rural areas.

Vomiting occurred in 75% of cases. Among the cases with history of vomiting 67% were induced by

the parents and care givers and the remaining 33% were spontaneous. Aspiration and subsequent development of chemical pneumonitis and other complications are common in vomiting. Among those cases who had vomiting 60% developed complications. There was no complications in children who didn't have vomiting.

On comparing the parent's education background most of the parent's studied upto high school (45%). Among the parents mother had higher qualification compared to father.

The parent's education is compared to those had vomiting induced by the caregivers. It showed no difference in relation to parent's education. This probably due to parents have little knowledge that the risk of aspiration increases with vomiting. Another possible reason is that vomiting was induced initially by the grandparents.

The quantity of kerosene ingestion hadn't taken to assess the outcome as the parents and care givers could not clearly tell the amount of ingestion. Moreover apart from the amount of ingestion, the quantity of kerosene get aspirated produces the complications.

Duration between poisoning and hospitalisation

Children with poisoning brought to the hospital with a mean of two and half hours and 82% of cases brought to the hospital within 3 hours of exposure.

On comparing the duration between poisoning and hospitalisation with the development of complications, it showed higher percentage of score and developing complication in those presented earlier. It is due to those with higher respiratory distress and CNS findings were brought to this tertiary care centre directly and those presented late were with less respiratory distress taken to nearby hospitals and later referred here.

Complications developed

18 (45%) subjects developed complications of which 17 persons had chemical pneumonitis and 1 subject need ventilator support and subsequently died.

Scoring system for hydrocarbon poisoning

The subjects were assessed by Scoring system for hydrocarbon poisoning on admission and every 2 hours upto 8 hours. Maximum score was attained at the end of 8 hours in all cases. The scoring system could be assessed bedside.

Among the manifestation of symptoms and signs, Respiratory involvement was more common than CNS involvement. The scoring system also has two parameters for the respiratory manifestations while single parameter for CNS manifestation to give more weightage to respiratory manifestations. The parameter 'Pulmonary involvement' is based on auscultatory findings and the parameter 'Respiratory distress' deals with the respiratory rate and accessory muscle use.

The score was compared with the complications developed during hospitalization. It was found that higher proportion of developing complications in the score categories 9 to 11 and 12 to 15. Only one subject within the category of score 12 to 15 had died.

Also the duration of hospitalization was compared with the score. The mean duration of hospitalization was 3 days with score 0 to 4, 5 days with score 5 to 8 and 9 days with score 9 to 11. So this scoring system is very useful in predicting the illness severity and clinical outcome with kerosene poisoning.

The statistical analysis showed a correlation coefficient of 0.849 which is a very high correlation. Maximum value of correlation coefficient is 1.0.

CONCLUSION

The Scoring system for hydrocarbon poisoning can be applied bedside and is useful in assessing the clinical severity and outcome of children with kerosene poisoning. Accidental kerosene poisoning is common among the children in developing countries like India. Young children less than 3 years and boys are commonly affected. Poisoning occurs commonly during summer. Kerosene

poisoning is common among rural population because of wide usage there compared to urban population. Vomiting is an important risk factor for the development of chemical pneumonitis and the duration of hospitalization.

Common presentation with kerosene ingestion is the respiratory distress and second common presentation is with CNS manifestations. Parents education is important in prevention of accidental poisoning of kerosene.

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