

Acute Formic Acid Poisoning :Analysis of 60 Cases From North Kerala



Medical Science

KEYWORDS : Border trade, Bodos, Bhutias, Economy

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ABSTRACT

Formic acid is one of the potent corrosive acids which lead to high morbidity and mortality in the victims.Acute formic acid poisoning has emerged as the second most common chemical agent used for deliberate self harm in the rubber growing areas of North Kerala. Though very common poison in this area, the studies and reports are very few in literature. To the best of our knowledge this study reports the largest number of patients with formic acid poisoning used for deliberate self harm.

Aims: To study the demographic and clinical profile of formic acid poisoning victims admitted in the toxicology unit of Academy of medical sciences, Pariyaram.Kerala India.

Material and methods: The study was a prospective observational study conducted among the patients who used formic acid for deliberate self-harm.60 patients admitted in the toxicology unit of department of medicine was studied in detail for the demographic data and clinical manifestations.

Results: 35 patients out of 60 expired due to various complications. Renal failure, DIC and GIT manifestations were common cause of death .

Conclusion: Formic acid poisoning has emerged as common chemical agent used for deliberate self-harm. This causes high mortality and morbidity among victims. Bleeding manifestations, DIC, hemolysis and renal failure were significant factors in predicting mortality. Statutory limitations on the availability of formic acid and social interventions are needed in the rubber growing areas of the state to curtail this increasing incidence of formic acid poison.

INTRODUCTION

Formic acid, also known as Methanoic acid is a Carboxylic acid and commonly used as preservative and antiseptic agent in the live stocks, electroplating and paper processing industries. 2% formic acid is now commonly used for the neutralization and coagulation of rubber latex. Recently there is a rapid spurt of rubber plantation in the state of Kerala, and accounts for 90% of the natural rubber production in India². Most of the hilly areas of Kerala now has abundant rubber plantation, and rubber processing done as an unorganized cottage industry. Formic acid is commonly used as an agent for deliberate self-harm due to the free availability and ready stock in the houses. In certain areas now the incidence of formic acid consumption for deliberate self harm surpassed that of organophosphorous poisoning. In spite of this increasing incidence of formic acid poisoning, major studies on formic acid poisoning is very less in literature. This study was conducted to understand the demographic and clinical profile of formic acid poisoning. We report a detailed study of 60 cases of formic acid from the North Kerala, in India.

PATIENTS AND METHODS.

Study setting: This study was conducted in the toxicology unit and Medical intensive care unit of department of internal medicine at Academy of Medical sciences, Pariyaram . The Academy of medical sciences Pariyaram is a major tertiary care center in the Northern part of Kerala state and an approved center for Medical Research.

Study design: This study was a prospective observational study.

Sample size : All patients admitted with history of acute formic acid poisoning in the toxicology unit and medicine intensive care unit under Department of internal Medicine with definite history and manifestations of formic acid were studied.. There were 92 cases of reported formic acid poisoning during the period of which 60 patients who full filled the selection criteria included in the study.

Period of study: 2 year from July 2010 to July 2012. **Inclusion criteria:**

Patients admitted in the Toxicology unit and Medicine Intensive Care unit under department of medicine with acute formic acid poisoning.

Exclusion criteria:

- Patients who did not give consent.
- Patients with double poisoning with alcohol, kerosene, other acids.
- Patients with other co morbidities possibly causing death.

Data collection: All the patients who fulfilled the inclusion criteria were selected for the study. The data were collected in well structured proforma. The Institutional Research Board approved the proforma and protocol used for the study. An ethical clearance was obtained from the institutional ethical committee. A detailed history from the patient or from a reliable relative regarding amount, its concentration, duration and other manifesting symptoms were obtained. On stabilizing the critically ill patients, a detailed physical examination was conducted. Biochemical tests, ABG analysis and OGD scopy was conducted as and when required and details were analysed. The statistical data were analyzed using SSPS 13 software with the help of Biostatistician.

RESULTS AND ANALYSIS

There were 92 patients admitted with history of formic acid poisoning during the study period. Of which 60 patients who full filled the inclusion criteria and clinical manifestation were studied in detail. The demographic profile of patients showed that 28.3% (n=17) were in the age group of 35-45 years. and 65 to 85 years constituted 14%. The sex distribution pattern showed a female dominance .53.3% of the cases were females (n=32) and 46.7% (n=28) were males.. Regarding the occupation, 33.3% (n=20) were directly involved in rubber cultivation. house wives and manual laborers were 18.3%. each and most of them from rubber cultivation areas. Of which 11.7% (n=7) who took formic acid for deliberate self harm were students.. Diluted formic acid was consumed by 56.7% of cases and diluted acid by 43.3%. The major symptoms and sign of for-

mic acid poisoning was given in table -1. Systemic examination showed that Gastrointestinal manifestation like Nausea, abdominal pain and vomiting were the major presenting features. 70% of patients had epigastric tenderness evident from examination of per abdomen. Respiratory complications like aspiration pneumonia (35%), pulmonary edema(20%), were also common initial manifestations. Other complications like Renal failure was observed in 63.3% of patients. 70% of patient who had acute renal failure responded to treatment. Disseminated intravascular coagulation was noticed in 30% cases, and intravascular hemolysis in 20%. Analyzing the mortality parameters it was noticed that 84.2% of the patients who developed Disseminated Intravascular Complications and 47.4% of those who developed hemolytic manifestations died. The comparison of clinical finding and outcome it was found that dysphagia(P Value=0.001) Hematemesis(p=0.001) Hematuria(p=0.001) cyanosis(p=0.001) DIC(0.001), Hemolysis(p=0.001) appeared as significant factor in predicting mortality. Biochemical profile showed only mild elevation in unconjugated bilirubin(20%). Electrolyte abnormality like hyperkalemia was observed in 40% of patients. Arterial blood gas analysis showed that most of the patients (63.3%) had metabolic acidosis.

Chart-1 Age distribution in formic acid poisoning

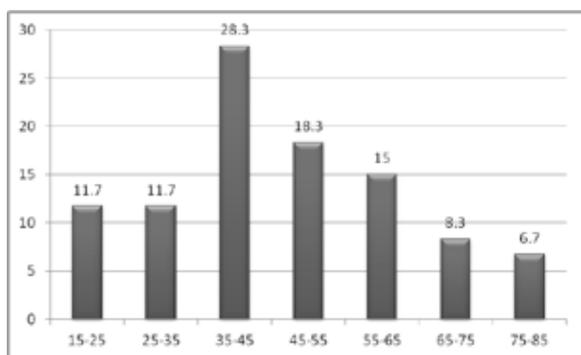


Chart 2: -occupation of formic acid poison victims.

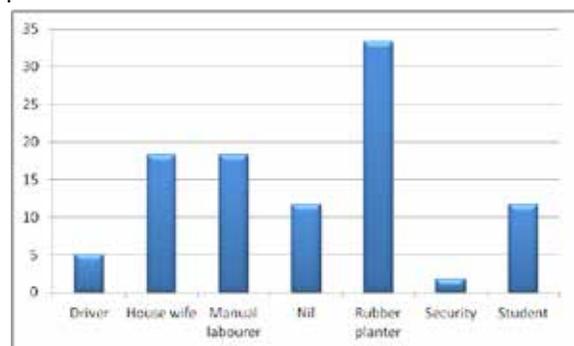


Table 1 : Common symptoms and clinical findings

SI NO:	Clinical Findings	Cases			
		Yes	Percentage	No	Percentage
1	Nausea	34	56.7	26	43.3
2	Vomiting	42	70	18	30
3	Abdominal pain	34	56.7	26	43.3
4	Head ache	9	15	59	85
5	Chest burns	21	35	31	65
6	Dysphagia	27	45	33	55
7	Hemoptysis	16	26.7	44	73.3
8	Breathlessness	27	45	33	55
9	Excessive salivation	44	73.3	16	26.6
10	Hematuria	37	61.7	23	38.3
11	Anuria	24	40	36	60
12	Melena	18	30	42	70

13	Oropharyngeal burns	37	61.7	23	38.3
14	Hematemesis	23	38.3	37	61.7
15	Syncope	19	31.7	41	68.3
16	Tachypnea	32	53.3	28	46.7
17	Pallor	22	36.7	38	63.3
18	Icterus	12	20	48	80
19	Cyanosis	29	48.3	31	51.7
20	Oedema	10	16.7	50	83.3

Table 2:Severity of mucosal injury

	Cases	Percent	Valid Percent	Cumulative Percent
GRADE 0	9	15.0	15.0	15.0
GRADE 1	9	15.0	15.0	30.0
GRADE 2a	18	30.0	30.0	60.0
GRADE 3a	6	10.0	10.0	70.0
GRADE 3b	4	6.7	6.7	76.7
Not done	14	23.3	23.3	100.0
Total	60	100.0	100.0	

Grade 0=Normal mucosa grade 3b severe mucosal injury.³

Chart 3: Renal parameters on admission and on recovery.

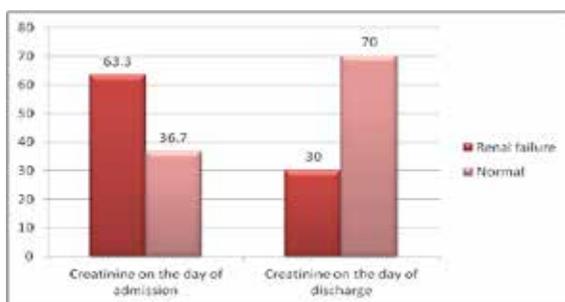


Table 4: Distribution of Outcome

	Cases	Percent	Valid Percent	Cumulative Percent
Death	19	31.7	31.7	31.7
Improved	41	68.3	68.3	100.0
Total	60	100.0	100.0	

DISCUSSION

During the last decades there is a rapid proliferation of rubber cultivation in the state of Kerala in India and Kerala rank first in the rubber cultivation in India. Formic acid is used as a preservative and in the coagulation of latex. Since rubber is processed and made into sheets before selling, several houses in the hilly areas of Kerala have adequate storage of formic acid, and this ready availability made this as a common poison used for deliberate self harm. In the other part of the country formic acid poisoning is rare. Studies on formic acid poisoning are only few. Hence this study is conducted to analyze the various clinical and biochemical and demographic profile of formic acid poisoning victims.

During the period of study there were total 92 cases of suspected formic acid poisoning. Of which 60 cases which fulfilled the inclusion criteria were selected for the study. The demographic profile showed that majority of the victims were in the age group of 35 to 45 years, and 15% of the patients in the elderly in the age group of 65 to 85. Study by Bhatra AK et al showed that 11.7% are by Bhatra AK et al showed that 11.7% of his patients were younger in the age group of 16-25 years.⁴

The mean age of victims in our study was 47.76, and is higher by 5 years in another study from the southern part of Kerala by Ashish J Mathew and Dalus5. We noticed that 53.3% female and 46.7% were males were the victims. Cyriac Job in a retrospective analysis on poisoning from the district of Trichur reported a male preponderance.⁶

But several other studies reported female preponderance as noted by us. Analysing the occupation it was found that 33.3% of the patients engaged directly in the rubber plantations related work. Higher incidence of formic acid poisoning among rubber plantation workers were also reported by Naik SM, Ravindran S et al from Karnataka among rubber plantations workers in sullivan⁷. This higher number may be due to the ready availability of formic acid in the area. Severe oropharyngeal burns occurred in 61.7% cases, and gross hematuria in 40% of the patients. Fatal gastro intestinal burns was described by Naik RB et al.⁸. Renal failure was seen in 63.3% of patients at the time of admission. The high incidence of acute renal failure reflects the large fluid losses with resultant hypotension producing tubular necrosis, and the direct nephrotoxic effect of formic acid. A study done by D. B. Jefferys and H. M. Wiseman (1980) also showed high incidence of renal failure⁹. 70% of patients with renal failure had good response to treatment and recovery in renal failure. Early monitoring of creatinine, treatment with high dose folic acid and heparin free hemodialysis improved the renal parameters. The ABG studied showed marked metabolic acid as an important manifestation the overall mortality was 31.1% in this study. In this study renal failure, DIC,

gross hematuria and severe gastric injury were associated with higher mortality. Dalus D, et al in 2013 reported a mortality of 35% from Thiruvanthapuram¹⁰ were as burns in the mouth and throat associated with increased morbidity which warranted intervention like dilatation. Esophageal scarring was a common sequel in severe formic acid poisoning¹¹. In this study grade I to grade 3b gastric burns noticed in 61.7% patients, Hemolysis was noticed in 43.3% of our cases and similar finding noticed by Verstraete et al in formic acid poisoning victims.¹² The mortality in this study was 31.7% where as Rajan N et al in a case series from state of Kerala in 1985 reported that 15 patients out of 53 died.¹³ A study by Ashish J Mathew, Dae Dalus (2008) showed some of the rare complications like tracheo-esophageal fistula, pneumomediastinum and chemical injury to the cornea, this was not observed in our study. Pyloric obstruction is a common long term complication in formic acid poisoning¹⁴. There is no definitive antidote available and early hemodialysis found to be effective in preventing progression in 39-cases. High dose folic acid administration was found beneficial but need more studies on its efficacy.¹⁵ Early supportive treatment is the mainstay of treatment.

The majority of the patients studied had been given hydrocortisone in view of anticipated stricture as late complication, but the benefit of steroids in this condition has not been established.¹⁶ Estrera et al found higher incidence of gastrointestinal bleeding and perforation in patient using corticosteroid and recommended an aggressive surgical intervention to in case of corrosive acid poison¹⁷. Esophageal stricture was a major long-term problem for those who survived the ingestion of formic acid and most of patients needed serial upper gastrointestinal imaging and interventions.

SUMMARY AND CONCLUSION

The ready availability of formic acid in the rubber growing areas of Kerala is leading increased incidence of formic acid poisoning among rubber plantation workers and in their family members. This has emerged as the second commonest chemical used for deliberate self harm in the Northern part of Kerala state in India. There is a female preponderance and those in the middle age group are more involved. Most of the victims are involved in rubber plantation. More than 40% of the patients used concentrated formic acid for deliberate self harm. Gastrointestinal manifestations like vomiting, pain abdomen were initial symptom at presentation. 46.7% of the victims had gastrointestinal burns ranging from Grade 2a to 3b which caused increased mortality and long term morbidity in surviving patients. The con-

sumption of formic acid had a high mortality rate in our study was 31.7% of the victims died. Dysphagia, renal failure, Bleeding manifestations like hematuria, hematemesis, DIC, hemolysis and cyanosis were significant factors associated with mortality. ABG was abnormal in 63.3% with predominant Metabolic acidosis. Hemodialysis was beneficial in 39%. This is one among the large study conducted on formic acid poisoning and showed high mortality and morbidity among victims. In view of this All people working in rubber plantations should be made aware of the side effect of formic acid and its long term complications. Easy availability of formic acid should be curtailed by enforcing statutory limitation in its distribution. The use of formic acid should be strictly controlled and should have adequate precaution against its misuse.

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