

# Paradigm shift in pattern and prevalence of poisoning during COVID-19 pandemic

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## ABSTRACT

**Objective:** To assess the pattern, prevalence and outcome of poisoning cases reporting to hospital in North India during COVID-19 pandemic. **Material and Methods:** An observational, prospective study was conducted for 100 patients reporting to medical emergency with history of poisoning intake from April 2020 to January 2021. Age range was 14-85 years. Obtained data were analysed using descriptive statistics and results were expressed as percentage and mean. **Results:** Out of 100 patients (77M, 33F), mean age of 32.6 years, most cases belong to age group of 20-30 years and 50% were matriculates and majority of the patients belonged to Punjab and Himachal Pradesh. The most common poisoning agents consumed were corrosives (34%) followed by Aluminium Phosphide (24%). Respiratory distress (53%), loss of consciousness (43%), acute kidney injury (36%) were the common clinical presentations. PSS (Poisoning Severity Score) was moderate in 52% of patients, severe in 14%, fatal in 16% and minor PSS in 18% of patients. 16 patients with fatal PSS and 16 patients with moderate to severe PSS got expired. High mortality of 33% was seen in our study. **Conclusions:** The most vulnerable group in our study was of young males in age group of 21-30 years and less educated, who had lost their jobs due to COVID-19 pandemic lockdown. Corrosives were the most commonly consumed poison during lockdown. Our study found that scoring systems PSS and GCS were good assessment tools for degree of severity of poisoning at an early stage.

**Keywords:** Corrosives, COVID-19, pandemic, poisoning, PSS

## Introduction

Poisoning and drug overdose are the medical emergencies in which it is important to identify the incidence, pattern and the outcome in order to take relevant steps for stringent planning not only at the hospital level but also at the community level for its prevention and management. The current pandemic of COVID-19 has had a tremendous effect on the psychological state of the people.<sup>[1]</sup> The factors that have a grave psychological impact on the people of the country during these tough times are fear of the unpredictable future, economic slowdown, loss of jobs,

loss of source of income, uncertainty, loss of family member, loneliness etc., Besides these, frequently changing government guidelines regarding the restrictions, rapidly spreading and at times contradictory information by mass media and rumours/misinformation on social media concerning COVID-19 further creates panic among people leading to chronic depression and anxiety. It is feared that all these psychological problems would have more damaging effect in the coming times.<sup>[2]</sup> Although children are at lowest risk of death from COVID-19 infection but the effect of pandemic on their mental health due to loss of school hours and peer time, arguments with parents, feeling of isolation etc., remains a great threat.<sup>[3]</sup>

As shown by the past studies, before the COVID-19 pandemic, poisoning was among the fourth most common cause of deaths in rural India where the mortality rates vary from 15-30%.<sup>[4]</sup> In India, cases of poisoning are quite common due to the easy

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accessibility of poisons, increasing use of chemicals for industrial and domestic purpose and low cost of hazardous chemicals.<sup>[5]</sup> Certain factors that are liable for people to take poisons include domestic violence, history of addictions, emotional distress, depression, social isolation or financial losses and these could be addressed through preventive health programmes and community development efforts<sup>[6]</sup> by means of emphasizing the importance of training community health care workers to initiate mental health screening and intervention for the vulnerable population during COVID-19 pandemic.

Due to various restrictions during the lockdown, public was in great mental stress. People being home bound and having easy access to the home stored pesticides, herbicides and corrosives, so a rise in number of poisoning cases were observed. Furthermore, limited availability of transport facilities during the lock-down delayed the time of presentation of these patients to a proper treatment care centre, thus increasing the complications and leading to poor prognosis.

The primary physician being first person for emergency contact has an important role for rapid and appropriate therapy for most poisonings. So timely updation of current scenarios especially during COVID-19 pandemic is utmost need of the hour in better management of poisoning cases which was substantiated by study done by Keller EL *et al.*<sup>[7]</sup>

So, the present study was aimed to assess the pattern, prevalence and outcome of poisoning cases reporting to hospitals during COVID-19 pandemic.

### Material and Methods

This study was approved by the Institutional Research and Ethical Committee and was conducted over a period of 9 months from April 2020 to January 2021 vide reference no. INT/IEC/2020/SPL-984 dated 25/07/2020. A total of 100 patients with age more than 12 years, history of poison intake, requiring admission were selected for the study after taking informed consent of the patient/relative. A proforma was prepared with details of patient's demography, employment status, educational background, quantity and name of poisoning agents, clinical presentations, addictions, risk factors, complications developed. The level of consciousness and nervous state of patient was assessed by Glasgow Coma Scale (GCS) and each patient was evaluated on a scale of 15; the patients were classified into severe (GCS 3-8), moderate (GCS 9-13), and mild brain injury (GCS 14-15).<sup>[8]</sup> Severity of poisoning was assessed using the Poisoning Severity Score (PSS) and patients were graded as minor, moderate, severe, and fatal.<sup>[9]</sup> In the study both GCS and PSS was used to predict the mortality of patients and the correlation between GCS and PSS was also compared.

### Statistical analysis

Categorical variables were reported as counts and percentages. Group comparisons were made with the Chi-Square test/Fisher's Exact test. Continuous data were given as mean ± SD and range

or median and interquartile range, as appropriate. Normality of quantitative data were checked by measures of Kolmogorov Smirnov tests of normality. For skewed data comparisons for two groups were made by Mann-Whitney test. For normally distributed data, Student *t*-test was applied to compare 2 groups. For non-normally distributed data comparison based on the basis of PSS was made by Kruskal–Wallis test followed by Mann–Whitney test.

In order to determine, independent predictor for mortality; Logistic Regression analysis was carried out. The factors found to be significant in bivariate analysis by Chi-Square test/Fisher's exact test, Mann –Whitney test were put to Bivariate Logistic Regression Analysis and Odds Ratios were calculated. Sensitivity, specificity, positive predictive value and negative predictive value were calculated for mortality on the basis of PSS Score.

A *P* value <0.05 was considered significant. Analysis was conducted using IBM SPSS statistics (version 22.0).

### Results

A serial data of 100 patients with a history of poisoning during COVID-19 pandemic was analysed and correlation was done between various factors. Demographics and clinical presentations for these patients are shown in Table 1.

Among 100 patients, 77 were males and 23 were females [Figure 1] and the mean age of presentation was 32.6 years with age range of 14 to 85 years. In our study, greatest prevalence of poisoning was

**Table 1: Distribution of poisoning cases according to risk factors, addictions, clinical manifestations and organ involvement during hospital stay**

Parameters	% (n=100)
<b>Risk Factors</b>	
Past suicide attempts	13
Past psychiatric Illness	19
Suicidal Ideation	83
COVID-19 Positive Status	2
<b>Addictions</b>	
Alcohol	47
Smoking	26
Narcotics	16
<b>Clinical Presentation on admission</b>	
Gastro-intestinal Symptoms	90
Respiratory Distress	53
Loss of Consciousness	43
Mucosal Injury	44
Acute Kidney Injury	36
Cardiovascular Failure	21
Bleeding Manifestations	19
Acute Liver Failure	
<b>Organ Dysfunction</b>	
Respiratory Failure	49
Central Nervous System Involvement	42
Cardiovascular Failure	25

seen in the age group between 20-30 years [Figure 2]. The patients were from neighbouring states of Punjab (45%), Himachal Pradesh (22%), Haryana (14%), Chandigarh UT (16%), [Figure 3]. As for the educational background, it was observed that out of 100 patients, 50% were educated up to matriculation and 8% were illiterate [Figure 4]. Based on the employment status of the patients, it was observed that 42% had lost jobs during COVID pandemic, 13% were doing alternative part time jobs to earn living, 11% were unemployed, 14% were homemakers, 14% were working, 6% were students [Figure 5]. The most common poisoning agents consumed were corrosives (34%) followed by Aluminium Phosphide (24%) and organophosphates (22%) [Figure 6].

Regarding the risk factors for intake of poison, 83% had a history of suicidal ideation, 19% had a history of past psychiatric illness, 13% had a history of past poisoning attempts. It was found that out of 100, only 3 patients tested positive for COVID-19. The most common addiction among these patients was alcohol (47%) followed by smoking (26%) and narcotics (16%). In our study, common clinical manifestations with which patients

presented were gastrointestinal symptoms (90%), followed by respiratory distress (53%), loss of consciousness (43%), mucosal injury (44%), acute kidney injury (36%), cardiovascular failure was seen in 21% and bleeding manifestations were observed in 19% patients. During hospital stay, 49% patients developed respiratory failure, 42% CNS involvement, and 25% cardiovascular failure [Table 1].

GCS (Glasgow Coma Scale) score  $\leq 8$  was seen in 17 patients, score between 9 and 12 was seen in 23 and score between 13 and 15 was seen in 60 patients. PSS (Poisoning Severity Score) which is based on measurement of blood PH, Serum  $HCO_3^-$ ,  $K^+$ , glucose level and temperature monitoring, was fatal in 16% of patients, severe in 14%, moderate in 52% of patients and 18% of patients had minor PSS [Figure 7].

In the current study, total number of patients who expired were 33 [Figure 8]. By applying logistic regression for various variables in prediction of severity of mortality, respiratory distress ( $P$  value .018) and cardiovascular failure ( $P$  value  $< .001$ ) were found

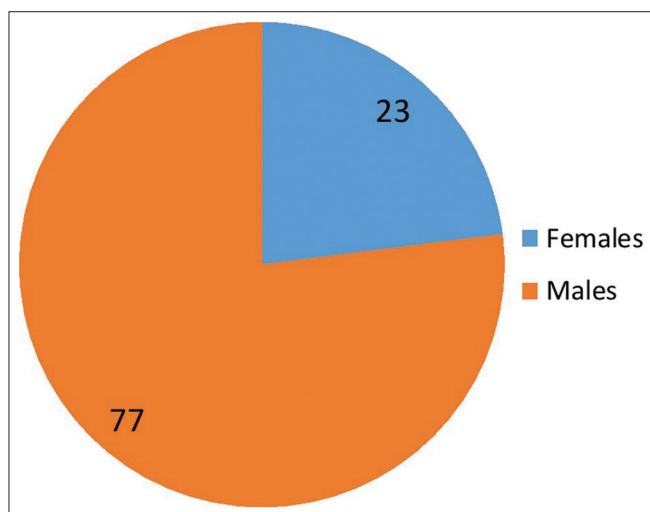


Figure 1: Pie diagram showing gender distribution

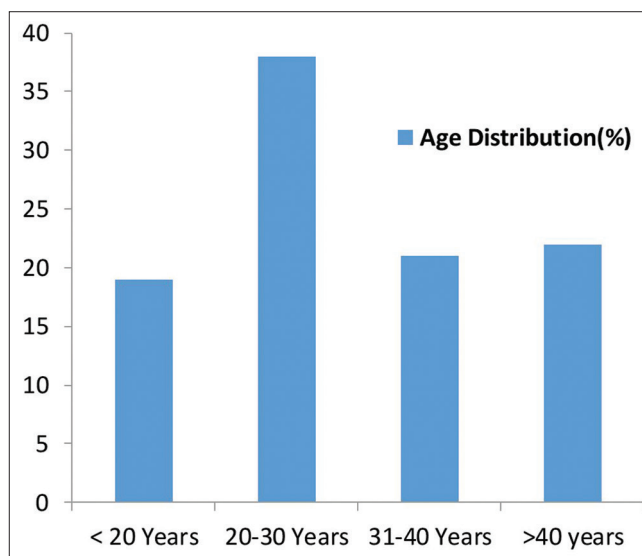


Figure 2: Bar Diagram showing age distribution

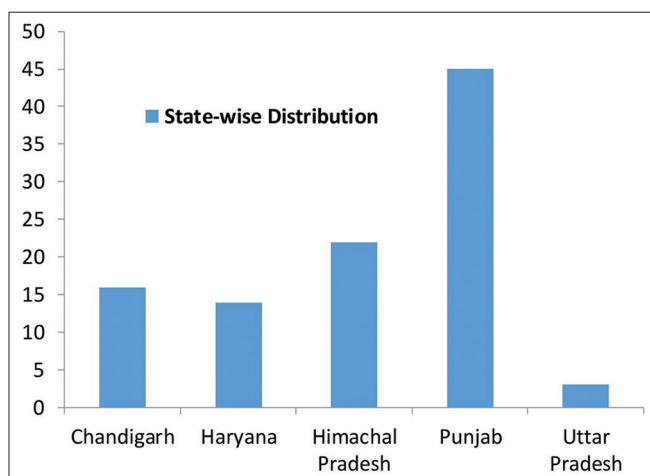


Figure 3: State-wise Distribution of the sample

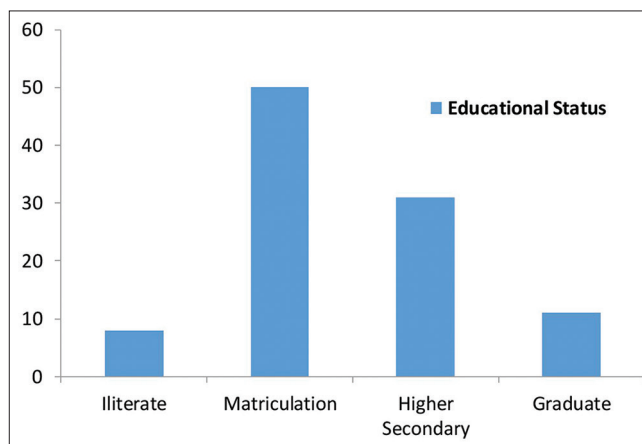


Figure 4: Patient Distribution based on educational status

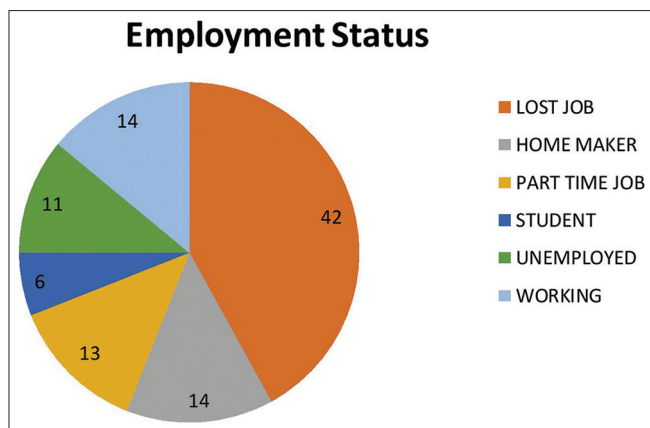


Figure 5: Pie Diagram depicting employment status of patients

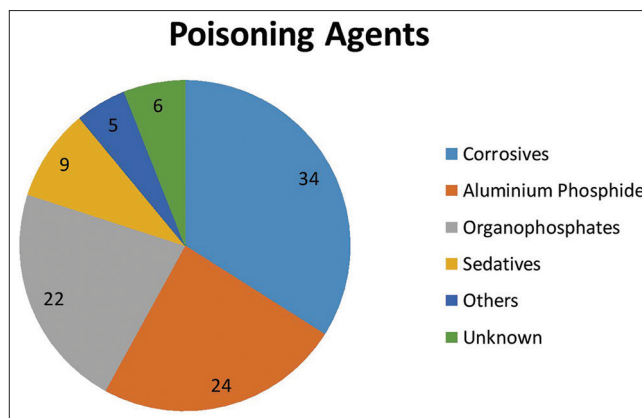


Figure 6: Poisoning cases as per poisoning agent consumed

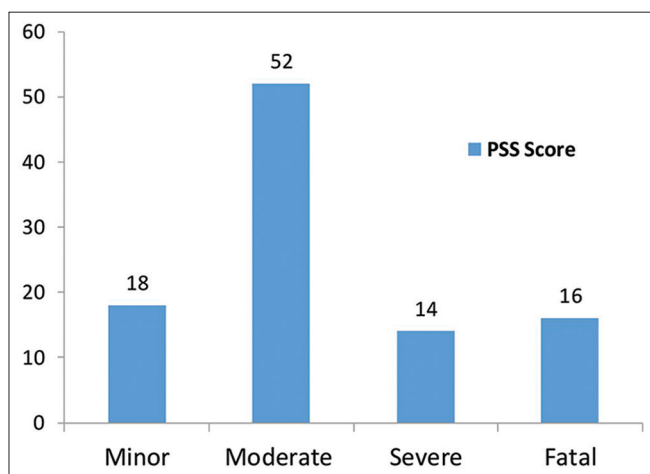


Figure 7: Distribution based on PSS Score

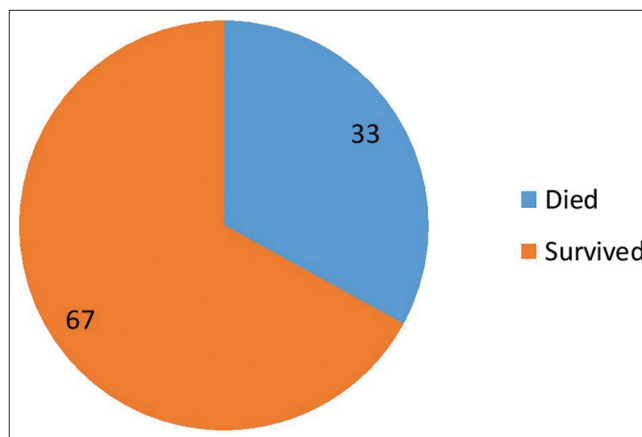


Figure 8: Outcomes of the patients

to be significant with very high odds ratios of 7.2 and 16.50 respectively [Table 2]. Among the causative agents, in our study, it was found that Aluminium phosphide poisoning had severe outcomes as compared to other poisonings with corrosives and organophosphates [Table 2]. Correlation of GCS (Glasgow Coma Scale) with mortality was significant. Out of 17 patients with score  $\leq 8$ , 12 expired ( $P < .0001$ ), 12 out of 23 patients with score between 9 and 12 died ( $P < .05$ ) and 9 patients out of 60, with score between 13 and 15 died ( $P < .0001$ ). Correlation of PSS with mortality revealed that all the 16 patients with fatal score got expired with a  $P$  value of  $<0.0001$  which was significant by chi-square test, 8 patients with moderate and 8 with severe score got expired ( $P < 0.0001$ ) and only 1 patient with minor PSS expired with a  $P$  value of  $<0.05$ . [Table 3]. Prediction of mortality in patients with moderate and severe grade of PSS had sensitivity of 75.35% and specificity of 95.47% and accuracy of 87.89%. For the correlation between GCS and PSS score,  $P$  value was .001, which was very significant [Table 4].

## Discussion

COVID-19 made the largest lockdown happen in the history of civilization which cruelly added to the miseries of daily wagers,

migrant workers and slum dwellers throughout India. Loss of jobs left these individuals unable to make both ends meet and this sudden poverty added to their remorse and disappointment, ultimately leading to functional impairment and increased rates of suicide.<sup>[10]</sup>

In developing countries like India, poisoning poses a major health challenge, with suicidal poisoning much more common than accidental intake of poison.<sup>[11]</sup> The economic consequences of the pandemic are likely to lead to a further increase in suicides as shown during past economic crisis.<sup>[12]</sup> Nordt *et al.*<sup>[13]</sup> highlighted increase in suicides due to economic crisis caused by loss of jobs. The Centre for Monitoring Indian Economy approximated that 27 million young people between the ages of 20–30 years had lost their jobs in April 2020 during the lockdown.<sup>[14]</sup> Another research analysis reported an increase by 2 to 7 times in number of suicides in northern states; Punjab, Uttar Pradesh, Haryana, Himachal Pradesh, Rajasthan.<sup>[15]</sup>

It is relevant to remark that this study was initiated in April 2020, when complete lock down was enforced in India to break the chain of transmission. So, the main objective of the study was to find the pattern, demographics and outcome of patients with a history of poison intake during the lockdown



**Table 2: Correlation between various parameters and mortality related to poison intake during COVID-19 pandemic (P<0.05 is considered significant)**

Parameters	Expired (%)	P
Total (n=100)	33%	
Age Groups		
<20 years	7 (21.2%)	
21-30 Years	12 (36.4%)	0.865
31-40 Years	8 (24.2%)	
>40 years	6 (18.2%)	
Gender		
Male	28 (84.8%)	0.191
Female	05 (15.2%)	
State		
Punjab	20 (60.6%)	0.088
Haryana	1 (3%)	
Chandigarh	6 (18.2%)	
Uttar Pradesh	1 (3%)	
Himachal Pradesh	5 (15.2%)	
Education Level		
Matriculate	18 (54.5%)	0.351
12 <sup>th</sup> Pass	12 (36.4%)	
Graduate	2 (6.1%)	
Illiterate	1 (3%)	
Employment Status		
Lost Job	14 (39.4%)	0.367
Part Time job	07 (21.2%)	
Un-employed	03 (9.1%)	
Working	03 (9.1%)	
Student	02 (6.1%)	
Poisoning Agents		
Corrosives	2 (6.1%)	
Aluminium Phosphides	17 (51.5%)	<.001*
Organophosphates	8 (24.2%)	
CNS Depressants	3 (9.1%)	
Unknown	2 (6.1%)	
Risk Factors		
Past suicide attempts	4 (12.1%)	1.000
Past psychiatric illness	6 (18.2%)	0.884
Suicidal Ideation	29 (87.9%)	0.413
COVID-19 Positive Status	2 (6.1%)	0.253
Addictions		
Alcohol	17 (51.5%)	0.525
Smoking	09 (27.3%)	0.839
Narcotics	06 (18.2%)	0.699
Clinical Manifestations		
Gastro-intestinal Symptoms	33 (100%)	0.028
Respiratory Distress	28 (84.8%)	<.001*
Loss of Consciousness	24 (72.7%)	<.001*
Mucosal Injury	8 (24.2%)	0.005
Acute Kidney Injury	17 (51.5%)	0.023
Cardiovascular Failure	17 (51.5%)	<.001*
Bleeding manifestations	07 (21.2%)	0.692
Acute Liver Failure	05 (15.2%)	0.871
Organ Dysfunction		
Respiratory System	26 (78.8%)	<.001*
Cardiovascular System	20 (60.6%)	<.001*
Central Nervous System	25 (75.8%)	<.001*

**Table 3: Correlation of GCS & PSS with mortality (P<0.05 is considered significant)**

Severity Scale	Total (n=100)	Outcome		P
		Survived (n=67)	Death (n=33)	
GCS				
≤8	17	5	12	0.0002**
9-12	23	11	12	0.025*
13-15	60	51	9	<0.0001**
PSS				
Fatal	16	0	16	<0.0001**
Severe	14	6	8	0.062
Moderate	52	44	8	<0.0001**
Minor	18	17	1	0.010*

period due to COVID-19 pandemic. The idea is to acquaint the medical professionals with the trends of poisoning cases during pandemics so as to plan for better management strategies. 100 patients who came to the medicine emergency with a history of poisoning intake from April 2020 to January 2021 were incorporated in our study. In our study, males were found to be involved more (77%) with similarity to study by Shah *et al.*<sup>[5]</sup> in which male (63.53%) preponderance was seen. Increased occurrence of poisoning in male could be because males are the sole breadwinners of the family, and were greatly stressed due to loss of jobs due to lockdown. According to our observations, 42% patients lost their job during the pandemic and 11% were unemployed, so approximately 50% of the cases were unemployed, further emphasizing that unemployment was the major cause of suicide during the pandemic.

Furthermore, prevalence of poisoning was more in patients with age group 20-30 years (38%) in agreement with other studies. Shah *et al.*<sup>[5]</sup> found that most of the poisoning cases were between 13-40 years of age (77.64%), among which 38.82% patients belonged to 21-30 years of age group and study by Singh *et al.*<sup>[16]</sup> showed that 41.82% of total cases belonged in the age group 21-30 years. This trend of younger generation being affected more is because this age group of 20-30 years is under tremendous stress to become financially independent besides family problems, marriage, and other life settlement issues. Another reason for younger age group being affected more could be because most of the young patients in our study were working as manual daily wage labour and were matriculate and illiterate (58%), but due to lockdown and closure of business establishments they could not move out to earn their livelihood. Similar finding was observed by Churi *et al.*<sup>[17]</sup> which demonstrated poisoning was seen in approximately 50% illiterates and less educated class.

In the current study, it was found that 83% had history of suicidal ideations, 19% had a history of past psychiatric illness, and 13% had a history of past poisoning attempts. This finding suggests that programs addressing mental health issues should be held more frequently to avoid fatal consequences.<sup>[18]</sup>

**Table 4: Correlation between GCS and PSS ( $P < 0.05$  is considered significant)**

	PSS				P
	Fatal	Moderate + Severe	Minor	Total	
GCS					
<=8	7	10	0	17	0.0006**
9-12	5	16	2	23	0.5125
13-15	4	40	16	60	0.0003**
Total	16	66	18	100	

On analysing the data for causative agent, it was observed that corrosives (30%) were the most commonly ingested poison, which is further corroborated by another study in which corrosive intake was seen in 27% patients.<sup>[19]</sup> This explains the paradigm shift in poison intake during lockdown as most of the accessible things in household were used, in contrast to other studies from North India in which poisoning with pesticide was more common.<sup>[20-22]</sup> This is because of the easy availability of corrosives, primarily used as toilet cleaners in plastic bottle without proper packaging and warning signs. Though Indian Government has issued guidelines for strict compliance in the sale of corrosives; more stringent action is still need of the hour.

The finding that common clinical presentation of patients with poisoning was respiratory distress (53%) is corroborated by another study in which respiratory distress was seen in 57%.<sup>[23]</sup>

Overall mortality in our study was 33% which is comparable to 15-30% mortality in developing countries like India.<sup>[24]</sup> Mortality was 6 times more in males (84.8%) as compared to females, in agreement to study by Ahuja *et al.*<sup>[25]</sup> in which twice more deaths were reported in males, which is reflective of mental status of males who were at home during COVID-19 pandemic and found it difficult to cope the mental pressures accompanying lockdown.

Further in the present study, 51.5% reported deaths were with aluminium phosphide poisoning. This was also noted in a previous study in which mortality with aluminium phosphide was seen in 53.2% of patients.<sup>[26]</sup> but in contrast to study done in Nepal by Shrestha *et al.*,<sup>[27]</sup> where pesticides were primarily used during same period.

This could probably be because patients reported late during lockdown and there is no specific antidote available for aluminium phosphide which was corroborated by study by Fayed MM *et al.*<sup>[28]</sup> which substantiated that there were delays in time from toxic exposure to access to emergency services during COVID 19 lockdown

In study by Churi *et al.*,<sup>[17]</sup> most of patients with PSS Scoring state were in mild (77%), moderate (18%) and none of patients expired in moderate category.<sup>[15]</sup> This however is in contrast to our study in which 18% were in mild, 52% were in moderate category, 14% were in severe category, 16% were in fatal category.

Mortality was seen in patients with moderate PSS score because of the delayed presentation to the hospital during lockdown owing to difficult access to the transport facility. So, condition of patients deteriorated faster. Resultantly many patients presented with multi organ dysfunction. Due to higher grade of PSS seen in our patients at the time of presentation mortality was 33% as compared to other studies in which mortality was only 1.5% and 1.3% respectively.<sup>[29,30]</sup> Results of our study is similar to Sam *et al.*<sup>[31]</sup> in which PSS score done exclusively for organophosphorus poisoning was of severe grade in 52.1%, moderate grade in 28.2% and fatal in 14% of sample, thus indicating the severity of disease with which patients presents.<sup>[32]</sup>

GCS score was similar to study by Churi *et al.*<sup>[17]</sup> as 60% patients had score more than 13 and patients with GCS >8 were 17. This may be because in their study patients presented with organophosphorus poisoning in contrast to our study most patients presented with corrosives and aluminium phosphide poisoning.

### Limitations of study

PSS was calculated once only at the time of presentation, whereas it should have been documented at 24, 48, 72 hours also for better prognosis and outcome of the patient. Secondly since PSS rely only on lab parameters, therefore some clinical predictors should have been ascertained like in our study hypotension, respiratory rate, Spo2, creatinine was seen as significant parameters. with a high odds ratio.

### Conclusions

- The most vulnerable group in our study was young males in the age group of 20-30 years, less educated and who had lost their jobs due to COVID-19 pandemic lockdown.
- We also observed that the majority of poisoning cases were intentional, hence signifying the need for psychological counselling of susceptible individuals.
- Corrosives followed by aluminium phosphide were the most commonly used poisoning agents used during lockdown.
- High mortality was observed in our study due to delayed presentation of patients because of lockdown and also due to lack of any antidote for Aluminium Phosphide.
- The clinical indices, GCS and PSS score, demonstrated excellent sensitivity with clinical outcome, thereby indicating their usefulness to predict severity in emergency centres.
- Stringent Laws should be framed to avoid easy accessibility of poisonous substances such as corrosives & pesticides especially in economically weaker nations to avoid their misuse as poisoning agents.

In our study, 51.5% reported deaths were with aluminium phosphide poisoning probably because there is no specific antidote available for aluminium phosphide. This necessitates future research to find a specific antidote and strict statutory measures over the sale of these agents.

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## Conflicts of interest

There are no conflicts of interest.

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