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ORIGINAL ARTICLE

Association of poisoning severity score with clinical outcomes in yellow oleander poisoning – a hospital-based observational study

SHAKTI BANSA[1], MANOJ KUMAR MOHANTY[2], SINDHU SUDHA SAHU[3,*], SATYABRATA GURU[4]

[1]Senior Resident, Department of Forensic Medicine and Toxicology, A.I.I.M.S., Rishikesh, Uttarakhand, India
[2]Professor and Head, Department of Forensic Medicine and Toxicology, A.I.I.M.S, Bhubaneswar, Odisha, India
[3]Associate Professor, Department of Forensic Medicine and Toxicology, A.I.I.M.S., Bhubaneswar, Odisha, India
[4]Associate Professor, Department of Trauma and Emergency Medicine, A.I.I.M.S., Bhubaneswar, Odisha, India

Abstract

***Background*:** Acute poisoning is a major cause of preventable morbidity and mortality. In India, plant poisoning accounts for 6-15% of poisoning cases, with yellow oleander (*Thevetia peruviana*) among the most common toxic plants. Despite its clinical importance, evidence regarding severity assessment and prognostic factors remains limited. The Poisoning Severity Score (PSS) is an internationally accepted tool for grading poisoning severity, but it has rarely been evaluated for Yellow Oleander Poisoning (YOP) in India.
***Methods*:** This prospective observational study assessed a modified Poisoning Severity Score in patients with YOP and evaluated its association with clinical outcomes. The modified PSS was recorded at admission, and patients were classified into grades 0 -4 based on the most severe clinical signs and symptoms. Patients were followed until discharge or death.
***Results*:** YOP accounted for 8.68% of all poisoning cases during the study period, with a case fatality proportion of 5.7%. Among 53 patients, the mean age was 30 years, and 64.2% were female. Most poisonings were intentional (88.7%), and ingestion of crushed seeds was the commonest mode of exposure (49.0%). Moderate poisoning (PSS Grade 2) was observed in 49.1% of patients. PSS grade showed significant associations with age, quantity of poison ingested, serum potassium level, duration of hospitalisation, and clinical outcome (all $p < 0.05$). Overall, 88.7% of patients recovered, whereas all deaths occurred among patients with higher PSS grades.
***Conclusion*:** The modified PSS is a useful tool for early assessment of severity and prognostication in Yellow Oleander Poisoning, supporting timely risk stratification and appropriate clinical management.

Keywords: Poisoning Severity Score (PSS); Yellow Oleander; Electrocardiogram (ECG); Morbidity and Mortality Association; Outcome

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INTRODUCTION

Poisoning-related morbidity and mortality remain a significant global concern, with WHO 2024-2025 reports estimating approximately 2 million deaths annually due to acute poisonings and chronic toxic exposures [1, 2]. Among these, plants account for about 5–10% of hazardous human exposures reported to Poison Control Centres in several Western countries, including the United States [3]. In India, a tropical nation with vast floral biodiversity, most plants are non-poisonous, yet a considerable number possess toxic potential. Within this spectrum, Yellow Oleander (*Thevetia peruviana*) is of particular importance because stands of its widespread distribution across India. It is a tropical and subtropical ornamental tree with milky sap-producing leaves and yellowish funnel-shaped blooms [4]. The diamond-shaped fruit contains multiple seeds that are highly toxic [4], with seeds carrying the highest concentration of Cardenolides (cardiac glycosides) among all plant parts [5, 6]. Owing to this, individuals aware of its potency often choose seeds for intentional consumption [6, 7].

The clinical profile of YOP is broad, ranging from asymptomatic cases to severe outcomes, including shock, syncope, and even death. Despite this spectrum, reliable data

*Correspondence to: Dr. Sindhu Sudha Sahu, Associate Professor, Department of Forensic Medicine and Toxicology, A.I.I.M.S, AT/PO – Dumduma, Bhubaneswar-751019, Odisha, India. Email: fmt_sindhu@aiimsbhubaneswar.edu.in, Phone: +91 9437371009

on incidence, severity, determinants of morbidity and mortality, and outcomes remain limited [8]. Due to its high regional prevalence and the lack of affordable, specialised therapeutic options, YOP has been categorised as a Neglected tropical disease within South Asia [9]. Indian epidemiological surveys suggest YOP accounts for approximately 7% to 15% of all poisoning-related hospital admissions in rural and semi-urban areas [9], but the condition is grossly under-reported, with available data being sporadic and often poorly documented [8, 10]. Inadequate maintenance of older hospital records and Poison Information Centre data further hampers accurate epidemiological assessment [10]. Consequently, there is limited research identifying specific parameters that associate with severity and fatality in oleander poisoning [8].

To address variability in clinical presentations, the International Programme on Chemical Safety, the Commission of the European Union, and the European Association of Poison Centres and Clinical Toxicologists (IPCS/EC/EAPCCT) introduced the Poisoning Severity Score (PSS) in 1994 [11, 12]. This scoring system provides a qualitative assessment of morbidity associated with poisoning based on clinical features and laboratory findings [11, 12], and prospective evaluation has confirmed its utility in identifying serious and complicated cases at initial assessment [12]. The PSS takes into account the overall clinical course and is applied according to the most severe symptomatology (including both subjective symptoms and objective signs).

However, despite its established role in toxicology, the application of PSS in estimating severity and its association with clinical outcomes in YOP remains scarcely explored within the Indian subcontinent. While previous studies have described the clinical features of oleander intoxication, the wide clinical range emphasizes the need to highlight mortality predictors more clearly [5]. Hence, the primary objective of this prospective study was to assess the PSS and evaluate its association with clinical outcomes in YOP cases admitted to our institute.

METHODS

This prospective observational study was conducted with the written approval and permission from the Institutional Ethics Committee (IEC) of AIIMS, Bhubaneswar, and was carried out in the Trauma and Emergency Department (ED) of AIIMS, Bhubaneswar, over 18 months. The consecutive sampling technique was used in this study. As the present study was time-bound, all consecutive samples admitted to the casualty of AIIMS Bhubaneswar between January 2022 and June 2023 that satisfied the inclusion and exclusion criteria were selected. Out of a total of 61 cases that were admitted with a history of YOP during the study period, 53 cases met the criteria and were included in the final analysis. Those cases with a history of simultaneous ingestion of more than 1 poison, or had underlying cardiac disease, or were on cardiotoxic drugs, or left against medical advice, and or presented after 24 hours after poisoning were excluded from our study.

Data were collected in a structured proforma to extract the socio-demographic, exposure-related, and clinical information. All this information was obtained through a comprehensive clinical history, involving the triangulation of information from the patient's or attendants' history and a review of referral documents from primary centres, if available. To assess the severity of the poisoning, the PSS was modified for YOP and was validated [11,12] and calculated at the time of admission at the study centre rather than through follow-up, thereby capturing the severity of the initial encounter. Written informed consent was obtained from the patient, and in emergency cases where the patients were unable to consent, consent was obtained from their legal representatives. The presence of sign(s) and symptom(s) was checked against the chart, and each case was assigned a PSS Grade (0-4) based on the most severe findings at admission. Patients were subsequently monitored clinically and investigated until discharge or death.

Statistical analysis was done using the Statistical Package for Social Sciences software (SPSS) version 26.0. Categorical variables were analysed using the chi-square test and summarised as percentages. However, for analyses having small cell counts (< 5), Fisher's test was substituted to ensure accuracy. Odds Ratios with 95% CI were calculated to see the strength of associations. In presence of zero-count cells, the Haldane-Anscombe correction was applied. All analyses were unadjusted and p-value <0.05 was considered statistically significant.

RESULTS

YOP represented %8.68 of total poisoning cases during the study period, with an annual incidence of 1.31 cases per 100,000 population in Khordha District, Odisha, and an observed case fatality proportion of 5.7%. A univariate analysis found a statistically significant association between the PSS at admission and clinical outcomes, with %88.7 of the cohort (n = 47) being discharged in a stable condition, of which 51.1% (n = 24) had moderate toxicity (PSS Grade 2). Notably, all of the deaths noted in this study were associated with higher initial grades of PSS, further validating the usefulness of PSS in early risk assessment for YOP.

Patient demographics and exposure characteristics

The socio-demographic characteristics of all study subjects are summarized in Table 1. Among a total of 53 YOP cases, the highest number of poisoning cases was observed among adults. No cases were reported in those under 10 years of age. The mean age and standard deviation were 30.02 ± 12.95 years; the median age was 27, with a range from 13 to 70 years. Females (64.2%) were more commonly affected than males (35.8%), with a female-to-male ratio of 1.78:1. The mean age and standard deviation for males and females were 31.42 ± 10.37 years and 29.24 ±

14.28 years, respectively. More than half of the poisoning cases were from joint families (Table 1).

Poisoning due to self-harm (88%) outnumbered the accidental poisoning cases (11%) by a huge margin. No

Table 1. Socio-demographic profile of cases

Variables and overall (n)	Poisoning severity score					Statistical test Value	p value
	None	Minor	Moderate	Severe	Fatal		
Age							
< 20 (n = 16)	2	6	7	0	1	38.951 (†)	< 0.05
21-30 (n = 18)	0	5	11	2	0		
31-40 (n = 12)	3	1	7	0	1		
41-50 (n = 1)	0	0	0	1	0		
51-60 (n = 5)	1	2	1	0	1		
61-70 (n = 1)	0	0	0	1	0		
Gender							
Male (n = 19)	3	4	9	2	1	1.219 (χ^2)	> 0.05
Female (n = 34)	3	10	17	2	2		
Marital status							
Married (n = 24)	3	5	13	2	1	5.735 (χ^2)	>0.05
Unmarried (n = 24)	3	7	12	1	1		
Widow/divorcee (n = 5)	0	2	1	1	1		
Familial status							
Single (n = 4)	0	2	0	1	1	16.45 (†)	**<0.05**
Nuclear (n = 20)	0	3	14	2	1		
Joint (n = 29)	6	9	12	1	1		
Education status							
Illiterate (n = 15)	2	4	7	1	1	2.33 (χ^2)	>0.05
Under metric (n = 18)	2	5	10	1	0		
Above metric (n = 20)	2	5	9	2	2		
Previous history of psychiatric illness							
Yes (n = 17)	1	3	11	1	1	2.76 (χ^2)	>0.05
No (n = 36)	5	11	15	3	2		
Employment status							
Government (n = 1)	0	0	1	0	0	10.79 (†)	> 0.05
Private (n = 3)	0	2	1	0	0		
Daily wage (n = 9)	3	2	3	0	1		
Household (n = 19)	2	4	10	2	1		
Unemployed (n = 21)	1	6	11	2	1		

χ^2- Pearson's Chi-square test, †- Fisher's Exact test (or Freeman-Halton extension). P-value < 0.05 was considered statistically significant

homicidal cases were reported. More than half of the poisoning cases (58%) were seen among the population that resided in rural areas, and the least among in urban areas. In 32% of cases with a history of Psychiatric illness, 7.5% had attempted self-harm by various means like hanging, poisoning, etc. Family disharmony (35.8%) was a primary reason for poisoning, followed by love affairs (32.1%) and marital issues. Accidental ingestion of oleander accounted for 7.5% of cases, and 3.7% did not reveal the reason for poisoning. Intake of seeds accounted for 49.06% of the cases, followed by fruit (33.96%) and multiple parts of oleander (Table 2). The most common form of consumption was in crushed form (75.4%), followed by an intact form like a pill (11.3%). In 11.3% of cases, the different parts of Oleander were taken by mixing it with sugar or jaggery or with some milk. After ingestion, 90.6% of cases received primary treatment at other hospitals before presenting to the study centre, in the form of decontamination measures like Gastric lavage, and stabilization of the patient was also done. Only 9.4% of patients reached the study centre within 3 hours of poisoning, while 37.7% presented within 3-6 hours and %8.0 after 6 hours, as detailed in Table 2.

When these demographic and exposure-related parameters were compared with the PSS, higher age categories, amount of poison taken, and primary treatment were more frequently associated with severe PSS grades ($p < 0.05$). Family status was associated with PSS in the unadjusted analysis and should be interpreted cautiously. All other parameters, like gender, education and employment status, manner and form of poisoning, part of poison and others were not associated with significant differences for PSS as shown in Tables 1 and 2.

Clinical spectrum of cases

At presentation, the clinical spectrum ranged from complete asymptomatic to a variety of manifestations. The majority of patients (54%) did not exhibit any obvious symptoms (such as palpitations, chest pain, or sweating) of cardiac involvement and 9.4% of cases of Gastrointestinal system involvement on physical examination. At the time of admission, %81.1 of cases had abnormalities in their Electrocardiogram (ECG), of which bradycardia was the most common abnormality (33.9%), followed by arrhythmias (13.2%). In the Gastrointestinal system, more than half of the cases presented with the main complaint of vomiting, followed by abdominal pain and loose stools. Neurological manifestations in the form of headache and dizziness were seen in 37.7% of patients, followed by drowsiness (28.3%). Less than 1/4th of cases also had respiratory difficulty at the time of admission (Table 3). Serum potassium levels were also noted at the time of admission, and 43% of cases had potassium levels within the normal range, 35.8% had Hyperkalaemia, and 18.8% had hypokalaemia. The association between the serum potassium levels and PSS grade was statistically significant (< 0.05).

After a detailed clinical evaluation of the clinical signs and symptoms, PSS was calculated for each case, and cases were classified according to the severity of poisoning (figure 1). To assess clinical risk, cases were grouped into Mild/Moderate (Low PSS < 3) and Severe/Fatal groups (High PSS ≥ 3). Within the Mild/Moderate group (86.8%, n = 46), 44 individuals got discharged in stable condition, while 2 fatalities were recorded. Conversely, the Severe/Fatal group consisted of 7 patients, resulting in 3 discharges, 3 clinical referrals and 1 death (Table 4). Odds ratio (OR) was calculated for certain variables to assess the strength of associations. Patients with a high PSS (≥ 3) had a significantly higher association with mortality when compared with patients having a Low PSS (< 3) (OR 31.0; 95% CI:1.41-682.3; $p < 0.001$) using the Haldane Anscombe correction for statistical stability (Table 4). Furthermore, hyperkalaemia at time of admission also showed a strong association with clinical severity with 11.8 times higher odds of having PSS Grade 3 or more (OR 11.8; 95% CI:1.25-110.6; $p = 0.03$). While ingestion of poison in crushed form was more frequent than intact form, the association between the form of consumption of poison and poor outcome did not have statistical significance (OR 0.61; 95% CI:0.09-3.84; $p = 0.66$).

Factors affecting the outcome of the case

When various parameters were compared with the PSS, a statistically significant correlation was found between amount, form, and part of poison taken and the PSS score ($p < 0.05$). All other parameters were not associated with significant differences for PSS as shown in Table 5.

DISCUSSION

This study highlights the importance of PSS in characterizing the morbidity and mortality associated with YOP. The primary findings of this study indicates a strong association between higher PSS grades at admission time and clinical outcomes. In addition, several clinical variables notably hyperkalaemia and ECG abnormalities, are significantly correlated with increased severity, suggesting that early PSS categorization can effectively identify patients requiring intensive cardiac monitoring. This initial assessment provides a practical framework for risk stratification in acute botanical toxidromes.

The highest incidence occurred in the 21–30-year age group (34%), followed by 11–20 years (30.2%), aligning with findings of previous studies [7, 13-15]. This vulnerability likely stems from the transition to independent life, where individuals face peak pressures regarding higher education, career expectations, financial stability, and marital or relationship conflicts.

Females predominated in the study at a ratio of 1.78:1, mirroring findings of previous studies [6, 7, 16, 17]. The reasons for female predominance remain unclear but may be influenced by sociocultural and regional factors. Consistent with studies [7, 18], suicidal intent was the primary motive in 89% of cases. Triggers included interpersonal conflicts, unemployment, and family disharmony. Notably, no

Table 2 . Association of PSS grade with the Exposure related variables (manner, amount, form, parts of plant, time delay in hospital admission, prior intervention, reason and place of ingestion)

Variables and overall (n)	Poisoning severity score					Statistical test Value	p value
	None	Minor	Moderate	Severe	Fatal		
Manner of poisoning							
Accidental (n = 6)	2	2	2	0	0	4.25 (χ^2)	>0.05
Suicidal (n = 47)	4	12	24	4	3		
Part of plant ingested							
Seeds (n = 26)	4	6	13	2	1	12.34 (†)	> 0.05
Fruits (n = 18)	1	7	8	1	1		
Leaves (n = 2)	1	1	0	0	0		
Flowers(n = 1)	0	0	1	0	0		
Multiple parts (n = 6)	0	0	4	1	1		
Amount intake							
<3 (n = 31)	6	10	15	1	0	33.26 (†)	**< 0.05**
>3 to <5 (n = 12)	0	4	5	2	1		
>5 to <7 (n = 4)	0	0	3	1	0		
>7 to <9 (n = 1)	0	0	0	0	1		
>9 (n = 4)	0	0	3	0	1		
Form of ingestion							
Crushed (n = 40)	4	10	20	3	3	8.75 (†)	>0.05
Intact (n = 6)	1	3	2	0	0		
Paste (n = 6)	1	0	4	1	0		
Others (n = 1)	0	1	0	0	0		
Delay in presentation to hospital							
< 3 hrs (n = 5)	0	3	2	0	0	16.56 (†)	>0.05
3 to 6 hrs (n = 20)	2	7	8	0	3		
6 to 9 hrs (n = 14)	2	2	7	3	0		
> 9hrs (n = 14)	2	2	9	1	0		
Any prior intervention?							
Yes (n = 3)	0	0	0	0	3	53.0 (†)	**<0.05**
No (n = 50)	6	14	26	4	0		
Reason of ingestion							
Love affair (n = 17)	0	7	8	1	1	5.012 (χ^2)	>0.05
Financial issues (n = 7)	0	2	4	1	0	1.977 (χ^2)	
Depression (n = 6)	0	1	4	1	0	2.566 (χ^2)	
Academic (n = 5)	0	2	3	0	0	1.87 (χ^2)	
Family discord (n = 19)	5	3	8	2	1	7.79 (χ^2)	
Marital issues (n = 10)	1	2	6	0	1	1.85 (χ^2)	
Others (n = 6)	1	2	3	0	0	1.18 (χ^2)	
Site of poisoning							
Rural (n = 31)	6	6	15	2	2	11.528 (†)	>0.05
Urban (n = 4)	0	0	4	0	0		
Others (n = 18)	0	8	7	2	1		

χ^2- Pearson's Chi-square test, †- Fisher's Exact test (or Freeman-Halton extension). p-value < 0.05 was considered statistically significant

Table 3. Association of PSS grade with the Clinical spectrum (gastrointestinal and central nervous system manifestation, ECG and duration of hospital stay)

Variables (n)	Poisoning severity score					Statistical test Value	p value
	None	Minor	Moderate	Severe	Fatal		
Gastrointestinal							
Abd. Discomfort (n=5)	1	2	1	1	0	35.9 (†)	<0.05
Loose stools (n=1)	0	0	1	0	0		
Pronounced Vomiting(n=13)	0	3	9	1	0		
Vomiting (n=29)	1	9	15	2	2		
No signs or symptoms (n=5)	4	0	0	0	1		
Central Nervous system							
Drowsiness (n=15)	0	3	9	2	1	23.015 (†)	< 0.05
Headache/ Dizziness (n=20)	1	9	9	1	0		
Vertigo (n=4)	0	0	4	0	0		
No sign or symptoms (n=14)	5	2	4	1	2		
ECG Findings at Admission							
1st AV Block (n=5)	0	0	5	0	0	58.35 (†)	**< 0.05**
2nd AV Block (n=4)	0	0	1	2	1		
Arrhythmia (n=7)	0	0	6	1	0		
RBBB (n=1)	0	1	0	0	0		
Sinus Bradycardia (n=18)	1	3	11	1	2		
Sinus Rhythm (n=15)	5	10	0	0	0		
Sinus Tachycardia (n=1)	0	0	1	0	0		
Others (n=3)	0	1	2	0	0		
Hospital stay duration							
<1 day (n=3)	0	0	0	0	3	78.664 (†)	**<0.05**
1-3 days (n=13)	6	5	2	0	0		
4-6 days (n=30)	0	8	19	3	0		
7-9 days(n=7)	0	1	5	1	0		

χ^2- Pearson's Chi-square test, †- Fisher's Exact test (or Freeman-Halton extension). P-value < 0.05 was considered statistically significant. ECG = Electrocardiogram

homicidal cases were recorded, likely due to the plant's repellent bitter taste.

Seeds (49%) and fruits (33.96%) were the primary modes of exposure with 75.5% of patients consuming the plant in crushed form to maximize toxin release and absorption [7]. Despite being aware of the plant's toxicity, rural residents (58%) often selected these specific parts for their high toxin concentration, a pattern supported by earlier studies [7, 13, 19, 20]. As a tertiary care facility, the hospital received 90.6% of patients after initial stabilization, such as gastric lavage or induced vomiting at peripheral centres [6, 7, 17]. Arrival was often delayed, with %52.8 reaching the facility after six hours and only 9.4% within three. These delays stemmed from the secretive nature of self-harm, late disclosure, and transit times between health centres. Clinical presentation primarily involved vomiting (54.7%), headache, and dizziness (37.7%). ECG abnormalities were found in 81.1% of cases, most notably sinus bradycardia (34%), alongside arrhythmias and various AV blocks. These conduction defects, similar to digoxin toxicity, align with

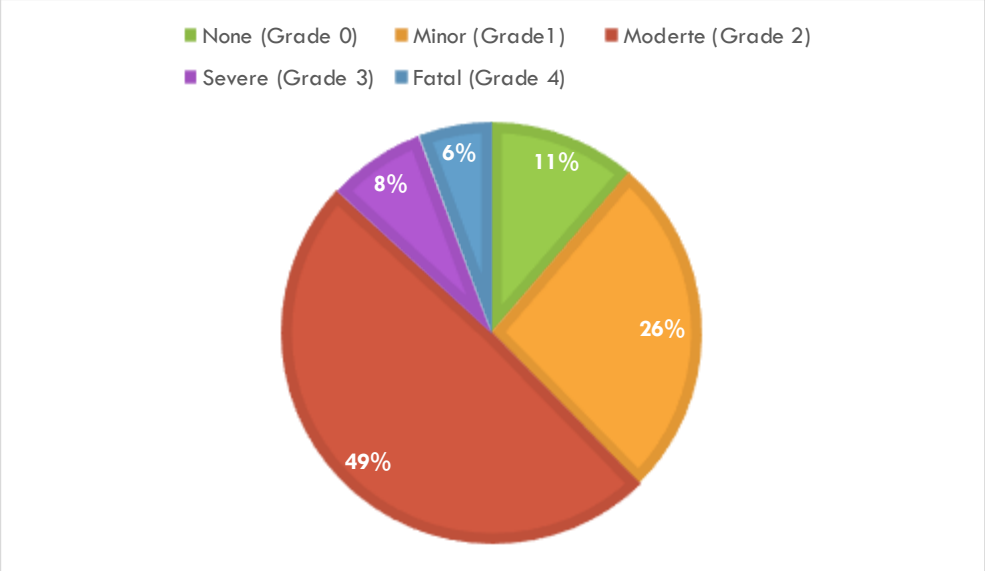

Figure 1. Poisoning severity score at time of admission

Table 4. Association of Poisoning Severity Score (PSS) with the Outcome

Outcome	PSS score at admission							
	None	Minor	Moderate	Severe	Fatal	Total	Statistical test Value	p value
Discharged in a fit state	6 (12.8%)	14 (29.8%)	24 (51.1%)	3 (6.4%)	0	47		
Referred	0	0	2 (66.7%)	1 (33.3%)	0	3	57.207 (†)	**<0.05**
Death	0	0	0	0	3 (100%)	3		

χ^2- Pearson's Chi-square test, †- Fisher's Exact test (or Freeman-Halton extension). p-value < 0.05 was considered statistically significant

observations by Eddleston et al. [16], Sivakumar DK et al. [13], and Fonseka et al. [21]. At admission, 11.3% of patients were asymptomatic, and 26.4% had mild symptoms, potentially due to prior stabilization. However, 56.6% presented with moderate to severe symptoms, underscoring the potent toxicity of Yellow Oleander. Of the 53 cases analyzed, 88.7% were discharged in a fit state, while 5.7% were referred or discharged in a morbid state due to resource constraints. Although the high volume of mild cases often lowers the median hospital stay, timely management, proper infrastructure, and the use of antidotes are critical for saving severe cases.

To quantify the burden of illness and standardize comparisons across poison centres, this study utilized the Poisoning Severity Score (PSS). Developed in 1994 by the IPCS/EC/EAPCCT, the PSS evaluates the entire clinical picture to grade severity. Previous studies by Paci et al. [22] and Sam et al. [23] have validated the PSS for assessing clinical signs and its association with clinical outcomes in various toxicological contexts. In this study, the PSS

Table 5 . Association of various factors with the outcome

Variables and overall (n)	Outcome				
	Discharged in a fit state	Referred	Death	Statistical test Value	p value
Part ingested					
Seeds (n=26)	24	1	1	21.264 (†)	**<0.05**
Fruits (n=18)	17	0	1		
Leaves (n=2)	2	0	0		
Flowers(n=1)	0	1	0		
Multiple parts (n=6)	4	1	1		
Amount intake					
<3 (n=32)	32	0	0	34.2333 (†)	**<0.05**
>3 to <5 (n=12)	10	1	1		
>5 to <7 (n=4)	3	1	0		
>7 to <9 (n=1)	0	0	1		
>9 (n=4)	2	1	1		
Form of ingestion					
Crushed (n=40)	36	1	3		**<0.05**
Intact (n=7)	6	1	0		
Paste (n=6)	5	1	0		
Delay in presentation to hospital					
<3 hrs (n=5)	5	0	0	8.4 (†)	>0.05
3 to 6 hrs (n=20)	17	0	3		
6 to 9 hrs (n=14)	13	1	0		
>9hrs (n=14)	12	2	0		
ECG Findings at Admission					
1st AV Block (n=5)	5	0	0	18.06 (†)	>0.05
2nd AV Block (n=4)	2	1	1		
Arrhythmia (n=7)	7	0	0		
RBBB (n=1)	1	0	0		
Sinus Bradycardia (n=18)	15	1	2		
Sinus Rhythm (n=15)	15	0	0		
Sinus Tachycardia (n=1)	1	0	0		
Others (n=2)	1	1	0		

χ^2- Pearson's Chi-square test, †- Fisher's Exact test (or Freeman-Halton extension). p-value < 0.05 was considered statistically significant. ECG = Electrocardiogram

demonstrated a significant association with some sociodemographic, exposure-related factors, and clinical outcomes ($p < 0.05$), suggesting that it is a reliable tool for assessing morbidity and mortality in YOP.

Overall, 88.7% of cases were assigned to the level of severity considering the PSS grade. Mild to moderate poisoning accounted for 75.5% of cases, while 13.2% showed severe to extremely severe poisoning.

Ingestion of crushed plant material was associated with greater severity compared to intact forms, likely because crushing optimizes the release and absorption of cardiac glycosides. In contrast, intact seeds often passed through the system like pills with minimal digestion. While 80% of cases consumed fewer than five units - mostly resulting in Grade 2 toxicity, even a single seed can induce severe effects. Notably, the quantity ingested did not correlate directly with mortality; patients consuming large amounts survived, while those who took less (e.g., 11 seeds or 5 fruits) succumbed. As noted by Eddleston et al. [16], Pirasath [24], and Bandyopadhyay [25] the quantity ingested alone cannot reliably predict the clinical outcome. Final results are likely influenced by variables such as age, comorbidities, stomach contents, and the speed of gastric lavage or medical intervention [26, 27].

YOP frequently disrupts potassium balance. In this study, 37.2% of patients developed hyperkalemia, which can cause reduced myocardial excitability and AV block, while 18.8% exhibited hypokalaemia. These electrolyte imbalances showed a significant association with severity (PSS), mirroring findings by Eddleston et al. [16], who reported 32.2% hyperkalaemia and a clear link to cardiotoxicity. While hypokalaemia likely due to induced or recurrent vomiting can worsen toxicity by increasing glycoside binding to the Na+ -K+ ATPase pump, both extremes can be fatal, necessitating rigorous monitoring.

The mean hospital stay was 4.62 days, consistent with observations by Karthik et al. (5.10 days) [17], Rafi et al. (4.55 days) [7], and Bose et al. (5 days) [20]. Increased stay duration correlated directly with higher PSS severity grades. The mortality rate was 5.7% (3 deaths), comparable to rates reported by Bose et al. (4.6%) [20] and Eddleston et al. (10%) [16]. Factors most strongly associated with mortality included female sex, extreme age (18 and 60 years), crushed ingestion of high seed volumes, delayed presentation, and severe cardiotoxicity, such as second-degree AV block and clinical shock. Although the time taken to reach the hospital may influence severity, this study did not find a statistically significant association between time to presentation and PSS grading. This may be because most cases had already received early treatment like gastric lavage, which reduced the immediate toxin effect. Similar observations were made by Bose et al. [20] and Rafi et al. [7].

Overall, the study findings indicate that several demographic and clinical factors like age, family status, amount of poison taken, primary treatment, mode of ingestion, and form of plant consumed was associated with

PSS in unadjusted analysis and should be interpreted cautiously. However, the PSS provided a simple and consistent way to grade these cases and help to assess various outcomes. This study addresses a gap in the Indian literature by validating the PSS as a reliable indicator of morbidity and mortality in YOP. It helped in planning management, identifying high-risk patients, and predicting hospitalization needs.

Study limitations include that all analyses are unadjusted (univariate) and the diagnosis was made solely on history without toxicological confirmation and potential recall bias in the amount and form of poison intake, as well as sampling bias due to the centre's proximity to other tertiary hospitals. Furthermore, pre-treatment at referral sites prevented PSS application to the initial poisoning state, while the lack of follow-up for discharged or referred patients may have influenced mortality data. Finally, this 1.5-year single-centre study had a small sample size (N = 53 and 3 deaths), so the results have limited generalizability.

CONCLUSION

The results of our study highlight that PSS is significantly associated with clinical outcomes in YOP. Patients presenting with a severe or fatal clinical picture (PSS ≥ 3) had a higher risk of mortality than those with a mild to moderate picture (PSS < 3). Despite limitations such as a lack of toxicological confirmation and pre-hospital stabilization, this study highlights the practical value of the PSS as a rapid triage instrument in acute emergency settings, where early identification of potential cardiotoxicity is vital for survival. Even though these findings are from an observational and unadjusted analysis, the standardized grading system is valuable for managing toxidromes. To confirm these associations and to establish more robust prognostic frameworks, there is a need for large-scale multicentre studies using adjusted analytical models.

Declarations

We acknowledge the use of the Google Gemini - AI tool to improve language and grammar.

Ethical Considerations

Approval was granted by the Ethics Committee of AIIMS Bhubaneswar vide ref no IEC/AIIMS BBSR/PG Thesis/2021-22/113.

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