

Poisoning Severity Score And Its Correlation With APACHE II And Glasgow Coma Scale In Predicting Outcome In Patients Presented With Poisoning In Emergency Department

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Abstract: **Background:** Standardized scales for scoring severity of poisoning is need of time in Emergency department (ED) to identify high risk patients for intensive monitoring and treatment before disposal and for compatibility of data. So in this study we try to evaluate utility of Glasgow coma scale (GCS), poisoning severity score (PSS) and Acute physiology and chronic health evaluation II (APACHE II) in estimating clinical severity and prognosis of poisoning patients. **Material and methods:** A Retrospective observational study was conducted between 1st June 2019 to 28th February 2021 in the Emergency Department of tertiary care teaching hospital, Ahmedabad, India. Data was collected from computerized hospital information system and analysed in CDC software Epi Info (version 7.3.2.1). **Results:** Out of total 50 patients during study, majority of patients were in age group of 21-30 year (yr) with Male: Female ratio of 1:1. Out of 50 cases, 44 consumed chemical substances, 3 had corrosive and 3 had medication consumption with organophosphates (OP) being most common compound. Mean PSS in expired was significantly high in comparison of survivors (p value= 0.0118). Present study found significant association between PSS within first 24 hours and GCS of patients presented with poisoning with p value 0.0117 (GCS on admission) and 0.0002 (GCS at 24 hr). A statistically significant correlation was found between PSS and APACHE II, with a p value= 0.0242 and also between GCS and APACHE II with a p value= 0.0018 (CI=95%). **Conclusion:** Both PSS and GCS are effective in predicting Severity and outcome of patients presented with poisoning in ED. GCS is more useful as it is easy to use, does not require any laboratory investigations and less time consuming. [Patel S Natl J Integr Res Med, 2021; 12(5): 28-35]

Key Words: Poisoning Severity Score, APACHE II, GCS

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Introduction: Poisoning is a significant global public health problem. World health organization (WHO) estimates that, in 2016, unintentional poisoning caused 106683 deaths and the loss of 6.3 million years of healthy life (disability-adjusted life year)¹. Every year 703000 people take their own life with suicide and there are many more people who attempt suicide². Over 77% of global suicides occurred in low and middle-income countries in 2019². It is estimated that around 20% of global suicides are due to pesticide self-poisoning, most of which occur in rural agricultural areas in low- and middle-income countries².

There were approximately 727,500 ED visits in the United States involving poisonings - 3.3% of all injury-related encounters in 2010³. Pesticides, corrosives, drugs, venoms and poisoning due to miscellaneous agents are common types of poisoning in India⁴. It is observed that agricultural or household pesticides and drugs

are taken intentionally, whereas intake of corrosives, kerosene and other miscellaneous agents as well as animal bites happen accidentally^{5,6}. The international programme on Chemical Safety Poison Severity Score (IPCS PSS) was developed by the International Programme on Chemical Safety, the European Community, and the European Association of Poisons centres and Clinical Toxicologists to create a scoring system that produces a qualitative evaluation of morbidity caused by different form of poisoning⁷.

The Poison Severity Score (PSS) has been developed to provide a standardized scheme for grading the severity of poisoning, better identification of risks, and it also importantly increases the comparability of data. The PSS is classification scheme for cases of poisoning in adults and children regardless of the type and number of agents involved. The PSS is intended to be a simple but relatively reliable system for describing a poisoning in qualitative terms and

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defining its ultimate severity⁸. The Glasgow coma scale (GCS), the acute physiology and chronic health evaluation (APACHE II) and poisoning severity score (PSS) are utilized in estimating severity and clinical prognosis patients with poisoning^{9,10}. There is a need to assess the usefulness of GCS, APACHE II and PSS to predict outcome in patient poisoned by different substance⁷. This study will help in evaluating utility of GCS, PSS and APACHE in identifying high risk patients for better management in Emergency department before disposal.

Material & Methods: Study Design: Retrospective Observational study. Study Place: Tertiary care teaching hospital, Ahmedabad. Study Period: 1st June 2019 to 28th February 2021

Inclusion Criteria: All patients presenting with history of consumption of or exposure to an unknown compound or known poison presenting with clinical features of poisoning.

Exclusion Criteria: Snake and other insect bite poisoning. Data of all patients fulfilling above criteria was entered in a structured case record from containing information of demographics, toxic substances involved, type of poisoning, amount, form, clinical symptoms, arrival time to ED, laboratory tests, management and patient's outcome. Data was obtained from computerized hospital information system.

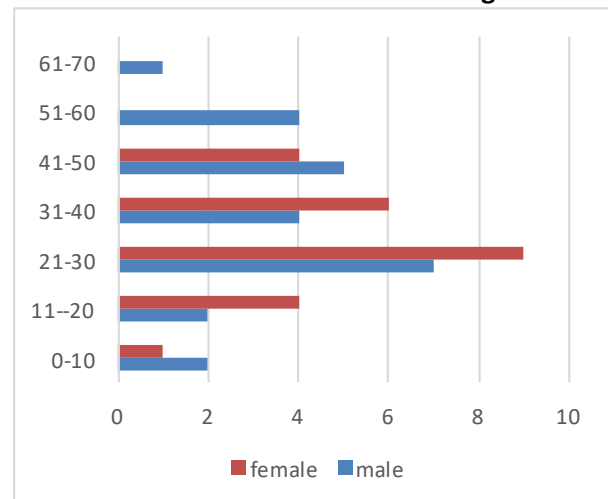
State of consciousness and mental status at the time of admission and after 24 hr were assessed by using GCS in form of eye opening response (1-4), best verbal response (1-5) and best motor response (1-6). The lowest possible GCS score was 3/15 and highest score was 15/15. The prognosis and predicted mortality rate was estimated using APACHE II scale. APACHE II score was calculated from 12 routine physiological and laboratory parameters in first 24 hrs. The score for each parameter was assigned from 0 to 4. In which 0 being normal and 4 being the most abnormal.

The point score between 0 to 71 was measured in first 24 hours of admission to ED. The predicted mortality rate was calculated by using APACHE II score. Outcome was also predicted by PSS that rates signs/ symptoms of 11 body aspects on scale 0-4 (none, minor, moderate, severe, fatal). Data was analysed in Epi Info (version 7.3.2.1) CDC software.

Results: 1: Patient Demographics: Total 50 patients of various type of poisoning were studied out of which 25 were males and 25 were female patients. Mean age of patients was 32.72± 14.78 yr. Mean age of female patients was 29.96± 11.63 yr and of male patients was 35.48± 11.63 yr. In present study, Majority of cases belongs to the age group of 21-30 yr (male=7, female=9) followed by 31-40 yr (male=9, female=6). The youngest patient was of 2 yr (accidental ingestion of pills) and oldest was of 68 yr. Mean age amongst survivors was 31.46 yr±15.10 yr and amongst non-survivors was 38.44 yr±12.39 yr.

66% of patients were married while 34% were unmarried. 33(66%) patients were uneducated, while 8(16%) had completed undergraduate study and 9(18%) had education up to primary school. Most common single occupation amongst poisoning patients was housewife(36%) followed by student(14%), unemployed(12%), labourer (8%), driver(6%), farmer(6%), shopkeeper(6%). Other occupations together constituted 8% of total patients. 84% of patients were non-alcoholic (n=42) and 16% were alcoholic (n=8).

Graph 1: Age And Gender Distribution Of Patients With Acute Poisoning



2. Pre-Hospitalization Period And Exposure Characteristics: Out of 50 patients, 39 (78%) patients reached hospital within 6 hr of consumption of poisoning. 9 (18%) patients reached between 6-12 hr and 2(4%) patients were brought after 12 hr of consumption. Only 1(2%) patient presented with inhalation while spraying OP Poison in fields, that is occupational exposure (farmer) to OP compound. 49(98%) patients had oral exposure. 43(86%) patients presented with poisoning with suicidal intent and 7(14%) were accidental.

3. Type Of Compound: Out of 50 patients, 45(90%) had consumed chemical substance, 3(6%) had corrosive consumption and 2(4%) had consumption of medication. Out of 50 patients, 23(46%) patients were of OP Poisoning, 7(14%) were of Aluminium Phosphide poisoning, 5(10%) were rat killing powder poisoning, 4(8%) were phenyl poisoning and 3(6%) were paint thinner. Out of 50 patients, 46% (n=23) were brought with OP Poisoning to ED Department, and the most common compound being Chlorpyrifos followed by Cypermethrin and Malathion.

Table 1: Various Types Of Poisoning

Type Of Poisoning	No. Of Cases
OP Poisoning	23
Aluminium Phosphide	7
Rat Killer Poisoning	5
Phenyl Poisoning	3
Acid Ingestion	3
Paint Thinner Poisoning	3
Copper Sulphate	2
Antipsychotic Drug	1
Benzodiazepine	1
Detergent Powder	1
Lysol	1

4. Clinical Characteristics And Outcome: Out of 50 patients, 36(72%) were hemodynamically stable while 14(28%) were hemodynamically unstable on admission. Out of 50 patients, 9 patients could not survive, 6 survived with requirement of intubation and mechanical ventilation and 35 survived without intubation. All intubations were required within 48 hrs of admission. Gastric

lavage was done in 34(68%) of patients. Average duration of hospitalization was 6.22±5.69 days (median 5 days). Out of 50 patients studied, all patients required ICU management. Average ICU stay was 5.43± 5.09 days (median 4 days), with average ICU stay in survivors was 4.90± 4.18 days (median 4 days) and was 8.44± 7.71 days (median 7 days) in non-survivors.

5. Poisoning Severity Score: Distribution of poison severity score of patients studied shows 28(56%) patients with grade 1 poisoning, 14(28%) patients with of grade 2 poisoning, 5(10%) patients with grade 3 poisoning and 3(6%) patients with grade 4 poisoning. Present study found significant association between PSS within first 24 hours and outcome of patients presented with poisoning. In our study, Mean PSS in expired was significantly high (3±1) in comparison of survived (1.36±0.53), with p value of 0.01182. Mean PSS was also higher in patients requiring intubation (2.667±0.899) as compared to non-intubated patients (1.22±0.42). Patients with grade 3 or 4 PSS associated with longer ICU stay and longer duration of hospitalization.

Graph 2: PSS Grading

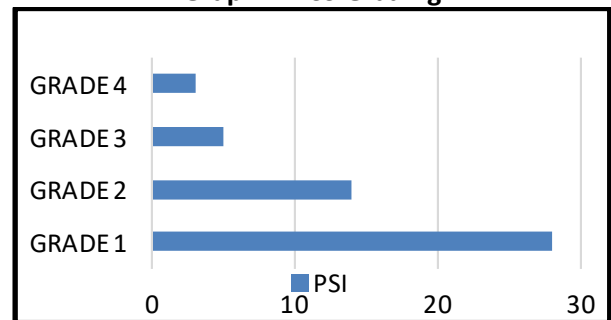


Table 2: Association Of Poison Severity Score With Outcome In Patients Studied

PSS Grade	Intubation		Outcome			Average ICU Stay (Days)	Average Duration Of Hospitalization (Days)	Total
	Required	Not Required	Survived	Survived With Intubation	Not Survived			
1	1(2%)	27(54%)	27(54%)	0(0%)	1(2%)	4.17±3.09	4.17±6.15	28
2	6(12%)	8(16%)	13(26%)	5(10%)	1(2%)	8.14±4.54	8.14±4.70	14
3	5(10%)	0(0%)	1(2%)	1(2%)	4(8%)	15.4±7.03	15.4±9.53	5
4	3(6%)	0(0%)	0(0%)	0(0%)	3(6%)	1±0	1±0	3

6. Glasgow Coma Scale: GCS can serve as a reliable tool for evaluation of mental status and the severity of poisoned patients at ED. GCS scores were ≤8 in 9 patients at admission and 8 patients at 24 hr. GCS scores were 9-12 in 6 patients at admission and 6 patients at 24 hr and GCS score were 13-15 in 35 patients at admission and 36 patients at 24 hr. Intubation and mechanical ventilation was required in all

patients with GCS <8 at admission, 5(83.33%) patients with GCS of 9-12 at admission and 1(2.8%) patient with GCS of 13-15 at admission. Intubation and mechanical ventilation was required in all patients with GCS <8 at 24 hr., 5(83.33%) patients with GCS of 9-12 at 24 hr and 1(2.7%) patient with GCS of 13-15 at 24 hr. Out of all 9 deaths, on admission 5 had GCS of < 8, 3 had GCS of 9-12 and 1 had GCS of 13-15. Out of all 9

deaths, at 24 hr, 8 (88.88%) had GCS of < 8 and 1 (11.11%) had GCS of 9-12. Average duration of hospitalization and average ICU stay was also in higher in patients with GCS of <13 (moderate to severe Grade) as compared to GCS of 13-15

(mild). In present study, there is strong association between GCS on admission and at 24 hours, with outcome and requirement of intubation and mechanical ventilation in acute poisoning.

Table3: GCS At Admission And Outcome

GCS At Admission	Outcome			Intubation		Average ICU Stay (Days)	Average Hospitalization (Days)	Total
	Survived Without Intubation	Survived With Intubation	Death	Required	Not Required			
<=8	0 (0%)	4 (8%)	5 (10%)	9 (18%)	0 (0%)	10 ±6.67	9.77 ±6.59	9(100%)
9-12	1(12%)	2(4%)	3(6%)	5(10%)	1(2%)	6.88±8.25	9.5±10.17	6(100%)
13-15	34(68%)	0(0%)	1(2%)	1(2%)	34(68%)	4.74±3.05	4.17±3.08	35(100%)

Table 4: GCS At 24 Hr And Outcome

GCS Score At 24hr	Outcome			Intubation		Average ICU Stay (Days)	Average Hospitalization (Days)	Total
	Survived Without Intubation	Survived With Intubation	Death	Required	Not Required			
<=8	0 (0%)	0 (0%)	8 100%	8(16%)	0(0%)	8.87±8.13	8.87±8.13	8 (100%)
9-12	0(0%)	5(10%)	1 (2%)	5 (10%)	1 (2%)	8.83±7.05	10.83±10.06	6 (100%)
13-15	35 (70%)	1 (2%)	0(0%)	1(2%)	35(70%)	4.25±3.12	4.86±3.25	36 (100%)

7. PSS And GCS Score: Present study found significant association between PSS within first 24 hours and GCS of patients presented with poisoning with p value 0.0117 (on admission) and 0.0002 (at 24 hr).

between GCS and APACHE II (for GCS at admission $r = -0.68354$ and for GCS at 24 hr $r = -0.63129$) with p value of 0.0018 (CI=95%).

Table5: PSS And GCS

Poison Severity Score	GCS (On Admission)	GCS (>24 Hrs)
Grade 1	14.89± 0.56	14.85± 0.75
Grade 2	11.14± 3.57	13.0± 2.80
Grade 3	8.80± 3.76	6.40± 2.88
Grade 4	8.66±1.52	4.33± 2.30
	P=0.0117	P=0.0002

8. APACHE II Score: Highest APACHE II score in patients studied was 24 and lowest was 0. 43 patients had APACHE II score in range of 0-10, patients had APACHE II SCORE in range of 11-20 and 4 patients had APACHE II score in range of 21-30.3 Mean APACHE II Score in survivors without intubation was 3.20± 1.92, survivors with intubation was 9.33± 7.31 and was 13.33± 7.74 in non-survivors. A statistically significant correlation was found between PSS and APACHE II ($r = 0.379767$) with a p value= 0.0242 and also

Discussion: The present study was conducted among the patients presented with consumption of various types of poisoning at Emergency Medicine Department, Tertiary care Hospital, Ahmedabad between 1st June 2019 to 28th February 2021. This study was conducted to assess efficacy of clinical scoring system, mainly GCS and PSS, to predict severity and outcome of the patient presented to ED with various poisoning.

In present study, most of the patients were from age group of 21-30 yr, followed by 31-40 yr. In the studies by Thunga et al¹¹, Nilamadhab et al¹² and Kora SA et al¹³, majority of patients were from age group of 21-30 yr. Present study shows equal distribution among the male and female patients, including 50% were male (n=25) and 50% were female (n=25) patients. While in previous study of Sam KG et al¹⁰, 76% were male and 24% were females. Even in studies of Kishore Thunga et al¹¹ and Rao et al¹⁴, there were male predominance. While in studies conducted by

Kora SA et al¹³ and Banerjee et al¹⁵, there was female predominance. In present study 66% of patients were married. In study by Gupta R et al¹⁶ also found similar finding of 66.54 % of patients with poisoning being married. In present study majority of patients (66%) were uneducated. Study done by Pagdhune A et al¹⁷ also reported similar findings. In present study being as housewife was the most common occupation (36%) in patients with poisoning. Majority of patients in present study presented with suicidal (86%) intent than accidental (14%) with ingestion (98%) being most common route of poisoning. A large study from Pagdhune A et al¹⁷ (n=1373) also reported in their study that majority of patients had suicidal intent (79.02%) and having ingestion (91.62%) as most common route. Pagdhune A et al¹⁷ also reported housewife as most common occupation with rising trend over 3 yr.

In our study, OP Poisoning was the most common type of poisoning with Chlorpyrifos being the most common compound. In the studies done by Akdur et al¹⁸ and Davies et al⁹, commonest compound was Chlorpyrifos. As India is a predominantly agricultural country, ease of availability, lack of knowledge about hazards of pesticides and lack of knowledge of handling of pesticide might be the reasons for OP being commonest compounds for poisoning. The average time lapse between exposure to the time of admission at the ED (pre-hospitalisation period) was 3.96±3.92. In study conducted by Banerjee et al¹⁵, mean pre-hospitalisation period was 4 hours. In study done by Thunga et al¹¹, it was 3 hours and in study by Kora et al¹³, it was 4 hours. The average pre-hospitalisation time was nearly similar (3.96±3.92) in our study as compared to other studies.

Early management of poisoning patients is an important factor in determining outcome¹⁹. As duration between ingestion and first medical contact increases, unabsorbed poison gets in circulation increasing peak level and causing hazardous effects. In present study Gastric lavage was done in 68% of patients. Naderi et al²⁰ also reported that 63% of surveyed health care professional used gastric lavage in their 90% of patients. Position paper was published by the American Academy of Clinical Toxicology and the European Association of Poisons Centres and Clinical Toxicologists concluded that at present there is no evidence showing that gastric lavage should be used routinely in the management of

poisonings²¹. Further, the evidence supporting gastric lavage as a beneficial treatment in special situations is weak²¹. This indicates that despite of lack of evidence gastric lavage is still widely used in India in poisoning. In present study 30% of patients require intubation. Study done by Pagdhune et al¹⁷ 21.04% patients with poisoning required intubation and mechanical ventilation. Out of 50 patients, 41 patients were discharged (82%) and 9 patients (18%) died, Out of which 5 females (55.56%) and 4 males (44.4%). Aluminium phosphide is the most common component causes mortality This correlates with the studies done by Thunga et al¹¹ and Nilamadhab et al¹², as they had similar mortality rate of around 25%.

The PSS is intended to be a simple but relatively reliable system for describing a poisoning in qualitative terms and defining its ultimate severity. In present study, PSS of grade 3 and 4 was associated with higher requirement of intubations (p=0.00001762), longer ICU stay (p=0.016), longer hospitalization (p=0.019) and higher mortality (p=0.00000036). PSS was also positively correlated with mortality (r=0.774). PSS correlated well with APACHE 2 (r=0.379) and GCS (r=-0.7114 for GCS on admission and r=-0.841 for GCS at 24 hrs). Here it indicates that higher PSS grade is correlated with lower GCS score.

In present study, Mean PSS in expired was significantly high (3±1) in comparison of survived (1.36±0.53), with p value of 0.01182. Mean PSS was also higher in patients requiring intubation (2.667±0.89) as compared to non-intubated patients (1.22±0.42). In study done by Sam KG et al¹⁰ there was significant correlation between mortality and PSS. Studies done by Sam KG et al¹⁰ and Akdur O et al¹⁸ also revealed significant correlation between GCS and PSS.

GCS was described by Graham Teasdale and Bryan J. Jennet, both professors of neurosurgery at the University of Glasgow in 1974 in their reports for neurological assessment of head injury patients²². Apart of head injury GCS is used in ED for neurological assessment regardless primary aetiology. The GCS is utilized for predicting adverse outcome and recovery, assessment of mental status, need for intubation, for predicting acute and delayed poisoning outcomes including mortality in patients with poisoning and drug overdose²³⁻²⁸. In present study, requirement of intubation (p value

<0.001 for GCS at admission and for GCS at 24 hr) and mortality ($p=0.00036$ for GCS at admission and $p<0.0001$ for GCS at 24 hr) were significantly higher in patients with GCS ≤ 8 as compared to patients with GCS of 13-15.

Requirement of intubation (p value <0.001 for GCS at admission and for GCS at 24 hr) and mortality ($p=0.0043$ for GCS at admission and $p<0.013$ for GCS at 24 hr) were also significantly higher in patients with GCS of 9-12 as compared to patients with GCS of 13-15.

GCS also correlated negatively with mortality ($r = -0.191$ for GCS at admission and $r=-0.284$ for GCS at 24 hr) which indicate lower GCS are correlated with mortality. Study done by Sam KG et al¹⁰ also revealed similar correlation between mortality and GCS. However, it has to be kept in mind that several centres consider GCS <8 as indication of intubation.

In present study overall clinical condition was considered before intubation. Out of 50 patients, 15 were intubated, from which 6 patients (40%) survived, but needed prolonged ICU stay and 9 patients expired (60%). 35 patients (70%) were survived without intubation. Study by Davies et al⁹ showed that intubation at admission or first 24 hours was highly specific for mortality. Grmec et al.²⁹ found sensitivity of 84.2% and specificity of 88.9% existed for GCS score in predicting respiratory failure.

Chan et al³⁰ found that an initial GCS score of eight or less was useful guide for intubation when used within a specific clinical context (sensitivity = 90%, specificity = 95%). Sungurtekin et al³¹, observed a significant correlation between the mortality and scoring scales systems, including APACHE II and GCS, and hence recommended the assessment of APACHE II scores in OP Poisoning patients. A significant correlation between APACHE II score and severity, observed in our study were similar to that observed in studies carried by Eizadi-Mood et al³².

Conclusion: Both PSS and GCS are effective in predicting Severity and outcome of patients presented with poisoning in ED and can be done easily in peripheral areas to identify high risk patients for urgent referral to higher centre. GCS is more useful as it is easy to use, does not require any laboratory investigations and less time consuming.

Limitations: Study duration was affected by corona virus pandemic which might have affected population distribution and number of cases.

Acknowledgment: We are thankful to Dr. Cherry shah, Dean of Smt. N.H.L Municipal Medical College, Ahmedabad and Dr. Sanjay Tripathi, Superintendent, S.V.P. Hospital, Ahmedabad for giving permission to conduct study. We are also thankful to our department, patients and institutional staff for their co-operation in completing our study successfully.

- List Of Abbreviations:
- PSS: Poison Severity Score
- APACHE II: Acute Physiology And Chronic Health Evaluation II
- GCS: Glasgow Coma Scale
- CDC: Centre For Disease Control
- W.H.O: World Health Organization
- OP: Organophosphate
- ED: Emergency Department
- Hr: Hour(S)
- Yr: Year(S)

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Conflict of interest: None

Funding: None

Cite this Article as: Patel S, Gajjar M, Jarvani B. Poisoning Severity Score And Its Correlation With APACHE II And Glasgow Coma Scale In Predicting Outcome In Patients Presented With Poisoning In Emergency Department. Natl J Integr Res Med 2021; Vol.12(5): 28-35
