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ORIGINAL ARTICLE

The Prognostic Value of Admission AVPU and Glasgow Coma Scales in Acute Drug Poisoning Patients

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Abstract

Background: Glasgow coma scale (GCS) was originally designed to be used in standardizing the assessment of conscious level in head trauma patients. However, GCS is now widely used in emergency departments as an indicator of the CNS status in patients regardless of their primary etiology. Alongside with GCS, AVPU scale (an acronym from "alert, verbal, painful and unresponsive") is a simpler system which can be used to measure and record a patient's level of consciousness. Therefore, the study investigated the values of admission GCS and AVPU as outcome predictor in mixed poisoned patients.
Method: A retrospective study in toxicology unit was performed on patients presented with mixed poisoning. Outcomes were recorded as patient necessity of GI decontamination, length of neurology observation and the length of hospital stay in toxicology unit.
Results: There was longer duration of hospital stay in toxicology unit and requirement of neurology observation in patients presented with lower GCS score (whether using cut-off point at 13 or 8). Similar findings were observed in AVPU scale analysis. Majority of patients did not require GI decontamination in both GCS score and AVPU analysis. However, it did not show any statistical significance ($P > 0.05$) in both group analyses.
Conclusion: Admission GCS score and AVPU scale both are not good indicators to predict severity in acute mixed poisoning patients. However, the use of AVPU scale may not be inferior to the use of GCS score in assessing acute poisoning patients.

Keywords: Acute Drug Poisoning; AVPU Scale; Glasgow Coma Scales; Prognostic Value

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INTRODUCTION

Glasgow coma scale (GCS) was first published by Graham Teasdale and Bryan J. Jennet, both neurosurgeons at University of Glasgow in 1974 (1). It was originally designed to be used in standardizing the assessment of conscious level in head trauma patients (2). However, GCS is now widely used in emergency departments as an indicator of the (central nervous system) CNS status in patients regardless of their primary etiology. As patients' brain will be influenced and may possibly be damaged by the biochemical ingredients of the toxic substances, this may also lead to the change of conscious level (3).

GCS has been widely used as a prognostic tool in evaluating the outcome and recovery of patients for their admission following drug overdose or mental status monitoring (4). It has also been used as a guide in determining the necessity for intubation in patients presenting with antidepressant poisoning (5).

Previous studies showed that GCS is the best indicator in assessing complications and mortality of poisoned patients (6-14). However, the use of GCS score as a prognostic indicator in terms of the length of hospital stays and the necessity of gastro-intestinal (GI) decontamination is lacking.

Alongside with GCS, AVPU scale (an acronym from "alert, verbal, painful and unresponsive") is a simpler system which can be used to measure and record a patient's level of consciousness (15, 16).

As drug poisoning is one of the most common reasons for emergency department toxicology unit admission, this study is designed to evaluate the values of GCS and AVPU in the outcome prediction of patients presented with acute drug poisoning.

METHODS

This is a retrospective study which was conducted at the toxicology unit of Department of Accident & Emergency, Queen Elizabeth Hospital (QEH). Patients admitted to the toxicology unit of Department of Accident & Emergency of QEH from 1st January, 2017 to 31st December, 2017 were recruited except those who were transferred from other hospitals for further management. Patients who presented with poison ingestion time exceeding 24 hours, prisoners and pregnant patients were excluded from this study.

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Two hundred and twenty-two patients with single or mixed-drug poisoning were recruited. All patients were followed until being discharged from the toxicology unit. Patients' demographic data, clinical vital signs, types of poisoning substances, GCS scores and its components, AVPU scale, length of hospital stay and necessity of GI decontamination were studied. The composite of GCS and AVPU scale on admission was collected by trained medical staff to ensure their accuracy. GCS was determined based on three components: eyes, verbal response and motor response. For AVPU scale, if the patient did not response to verbal stimulus, gentle shake was done without applying any form of painful stimulus. This was to ensure patients were not subject to hearing impairment.

Data were analyzed based on both GCS score and AVPU categories. A ninety-five percent confidence interval (CI) was used to show how predictive the GCS scoring or AVPU categories could be.

In GCS scoring group analysis, non-Parametric and Mann-Whitney test were performed to compare the length of neurological observation and length of hospital stay. Subsequent analyses were performed by independent sample t-test by using GCS score at 8 and 13 as cut-offs. The necessity of GI decontamination by using GCS score cut-off at 8 was analyzed by Crosstab and Chi square analysis.

In AVPU group, Post Hoc Tests and Kruskal-Wallis Test were performed to compare the length of neurological observation and length of hospital stay. Crosstab and Chi square tests were employed in the analysis of GI decontamination necessity. In AVPU group between A and non-A group, dichotomized sub-group analysis were also performed by using the same strategic methods.

The data were presented as mean +/- SE or n (%) when appropriate. Logistic regression was applied to calculate odds ratio (OR) with 95% confidence interval so as to show how predictive the GCS or AVPU was.

This study was approved by the hospital authority cluster research & ethics committee/institutional review board (REC/IRB) of Queen Elizabeth Hospital (Research Project Number: KCC/KEC-2018-0117).

RESULTS

In this study, 222 patients with mixed toxicology cases were included. Four cases were excluded because of incomplete medical records. There were more women (n=133) than men (n=85). The mean age was 41.89 years, ranging from 16 to 88 years old.

Our findings showed that eight patients [3.6%] required intensive care unit (ICU) support during their stay in the toxicology unit. Twelve patients [5.4%] required coalition care by either medical or surgical unit during their stay. Thirty-four patients [15.3%] required continual psychiatric care upon discharge. One hundred and eighty-one patients (83%) were discharged directly by physicians or self-discharged. Three patients [1.4%] required intubation. None of our patients died during the stay in our toxicology unit.

Twenty-five patients [11.3%] required GI decontamination. Among these twenty-five patients, one required activated charcoal (AC) plus multi-dose activated charcoal (MDAC), another one required AC plus gastric lavage (GL). The remaining patients required one single dose of AC as GI decontamination only.

One hundred and forty-one patients required neurology observation (NO) during their stay in toxicology unit. The longest duration requiring NO was 189 hours, while the shortest one was only one hour. Neurology observation was done by nursing staff. If there was any uncertainty, it would be reassessed by senior physicians.

For patients presented with admission GCS score 13 or above, the mean duration of hospital stay and requirement of NO was 1.7 days and 25.8 hours, respectively. However, patient with admission GCS score less than 13 required 1 day longer stay in the toxicology unit or required 17.5 more hours of NO (Table 1).

When using GCS cut-off point at 8, the mean hospital stay for patients with a GCS greater than or equal to 8 (≧8) was 1.95 days. It was 1.59 days longer than those with GCS score less than 8. The mean duration of NO requirement was 31.2 hours for patients with GCS score (≧8) which was 12.84 hours longer than those with a GCS <8 (Table 2).

Over 90% of patients with admission GCS score greater than or equal to 8 (≧8) did not require any form of GI decontamination (94.1%, n=176). However, among those who required GI decontamination, most of the patients (92%, n=23) presented GCS greater than or equal to 8.

In AVPU group analysis, the mean duration of hospital stay and requirement of NO also increased if patients' best consciousness level at admission changed [Table3]. A similar observation was found when we performed A and non-A sub-group analysis [Table 4]. Both the mean durations increased dramatically if poisoned patient presented as unconscious on admission (Figure 1).

Table 1. Duration of hospital stay & Neurology observation using GCS cut-off at 13

	GCS>13	N	Mean	Std. Deviation	Std. Error Mean
	GCS>13	N	Mean	Std. Deviation	95% CI Lower Bound / 95% CI Upper Bound
Duration of stay (days)	GCS below 13	59	2.737	4.3404	-5.9438 / 11.4178
	GCS greater than 13	148	1.787	1.4083	-1.0296 / 4.6036
Duration of NO (hrs)	GCS below 13	53	43.3443	77.39686	-111.4494 / 198.138
	GCS greater than 13	86	25.8017	24.77552	-23.74934 / 75.35274

Table 2. Duration of hospital stay & Neurology observation using GCS cut-off at 8

	GCS>8	N	Mean	Std. Deviation	95% CI Lower Bound	95% CI Upper Bound
Duration of stay (days)	GCS below 8	13	3.538	2.3493	-1.1606	8.2366
	GCS greater than 8	194	1.959	2.6208	-3.2826	7.2006
Duration of NO (hrs)	GCS below 8	13	44.1346	50.13821	-56.14182	144.411
	GCS greater than 8	126	31.2893	52.28004	-73.27078	135.8494

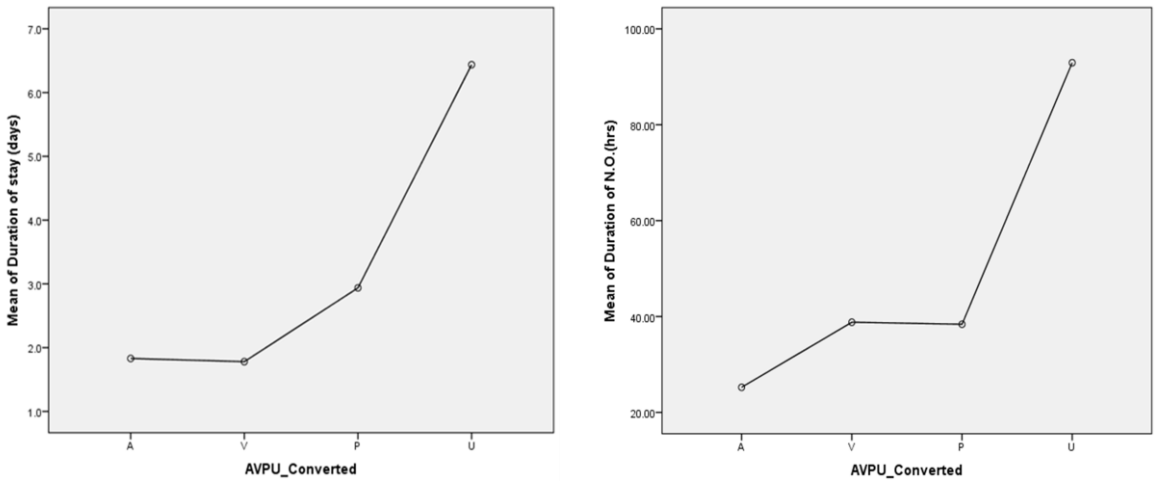

Figure 1. Means Plots of Duration of hospital stay and Neurology observation

For the necessity of the GI decontamination in the AVPU group analysis, majority of the patients (75.9%, n=145) did not require any form of GI decontamination. However, among those who required GI decontamination, most of them (84%, n=21) were alert patients.

A similar observation was made among the A and the non-A subgroup analysis. Majority of patients (87.3%, n=145) did not require intervention and most of them (84%, n=21) who required GI decontamination were alert on presentation.

DISCUSSION

This study investigated the values of GCS and AVPU in predicting the outcome of patients with mixed poisoning. To the best of our knowledge, this is the first study in which the relationship between GCS, AVPU and length of stay in hospital are studied.

A number of previous studies showed positive correlation between GCS and severity of poisoning. Unverir et al. demonstrated that anti-depressant poisoned patients with a GCS score of 8 or less were intubated more frequently (7). Budhathoki et al. showed that GCS less than eight was more associated with mortality in children presented with poisoning or intoxication (10). Heyman et al. illustrated that poisoned patients with a GCS score of less than 13 required ICU admission (17). Eizadi Mood et al. also showed that admission GCS and its components are valuable in outcome predictors in mixed poisoned patients (12). Our results basically showed that GCS, regardless of whether the cut-off was 8 or 13, would barely be able to statistically differentiate the outcome of patients irrespective of the terms of the hospital stay length (P = 0.078), necessity of GI decontamination [p=0.914] or the length of neurology observation (P = 0.5489).

However, it is argued that our group of patients may have suffered from different combinations of toxic agents from that of other studies and that our result is in conflict with them. It is evidenced by the fact that Davies et al. illustrated that the pesticide type affected the outcome in acute organophosphate poisoning (18). Besides, the use of antidote and the difference in physicians' intervention also have a great impact on the outcome prediction (19-22). As our study was based on mixed poisoned patients and different drugs may have different pharmacokinetics and pharmacodynamics, this will have a great impact on the final outcomes. Moreover, our results may not be directly extrapolated to other institutions as our patients' case-mix may not be representative of other groups of patients.

On the other hand, using AVPU also may not be of great help; in all categories, P value is greater than 0.05. Although the analysis showed that both the duration of NO and length of hospital stays increased dramatically if patient's initial presentation is unresponsive, it did not show any statistical significance in the A and non-A subgroup analysis. For the necessity of GI decontamination, it did not show any

Table 3. Duration of hospital stay & Neurology observation using AVPU scale

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	95% Confidence Interval for Mean
						Lower Bound	Upper Bound
Duration of stay (days)	A	162	1.830	1.4861	.1168	-1.1422	4.8022
	V	25	1.780	1.2754	.2551	-0.7708	4.3308
	P	16	2.938	3.1192	.7798	-3.3004	9.1764
	U	8	6.438	10.4418	3.6917	-14.4456	27.3216
	Total	211	2.083	2.6546	.1827	-3.2262	7.3922
Duration of NO (hrs)	A	93	25.2306	23.13269	2.39875	-21.03478	71.49598
	V	21	38.8095	36.93938	8.06083	-35.06926	112.6883
	P	15	38.3833	59.09231	15.25757	-79.80132	156.5679
	U	8	92.9375	174.18021	61.58200	-255.4229	441.2979
	Total	137	32.7058	52.38887	4.47588	-72.07194	137.4835

Table 4. Duration of hospital stay & Neurology observation using A vs. Non-A analysis

	A vs. Non-A	N	Mean	Std. Deviation	95% CI Lower Bound	95% CI Upper Bound
Duration of stay (days)	A	162	1.830	1.4861	-1.1422	4.8022
	Non-A	49	2.918	4.7427	-6.5674	12.4034
Duration of NO (hrs)	A	93	25.2306	23.13269	-21.03478	71.49598
	Non-A	44	48.5057	84.61306	-120.7204	217.7318

statistical significance in both AVPU group and the A, and the non-A subgroup analysis. Therefore, the results also revealed that the use of AVPU scale did not differentiate the outcomes either.

There are several limitations in our study. The GCS or AVPU measured at the time of admission may not reflect the unforeseeable major events that may be the determining factor of the outcome. Chronological evaluation may give a more accurate result.

For the duration of neurology observation, physicians tended to make this clinical order only in those patients presented with a low GCS score. The data analysis was greatly affected. A prospective study may be able to minimise this bias.

There were few cases in this study which required exceptional long hours for neurology observation even though they had attained full GCS score in very early stage, especially for those who had been admitted to ICU. It is argued that physicians tended to employ a more conservative and meticulous attitude towards the management of those ICU cases. Therefore, the use of parameter, such as improvement of GCS score or AVPU scale, may be more appropriate in future studies.

CONCLUSION

Although both GCS score and AVPU are useful and commonly use indicators in head injury and critically ill patients, they are not good indicators to predict severity in patients with acute mixed poisoning in terms of the length of hospital stay, necessity of GI decontamination or the length of neurology observation. However, the use of the AVPU scale may not be inferior to the use of GCS score in assessing acute poisoning patients. It would be of interest to have larger prospective studies to demonstrate the prognostic values of the admission GCS score or AVPU scale in acute mixed poisoned patients in future.

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