

Original Research Article

Prognostic factors of outcome in adults with non-traumatic altered mental status presenting to emergency department

Sheikh Hilal Ahmad^{1*}, Wani A. Mushtaq¹, Tak Sajad²

Department of Neurology, ¹Sheri Kashmir Institute of Medical Sciences, ²Government Medical College, Srinagar, Jammu and Kashmir, India

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*Correspondence:

Dr. Sheikh Hilal Ahmad,
E-mail: drhilal@gmail.com

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ABSTRACT

Background: Altered mental status (AMS) is a common presentation in the emergency department (ED) and poses a significant challenge to the emergency physician (EP). The prognosis seems to depend upon many diverse factors, like etiology of AMS, clinical variables and various laboratory tests.

Methods: The aim of the study was to determine outcome in patients presenting with new onset AMS to emergency department in our population. And further to look for various prognostic factors for death. Adult patients aged >14 years, not having dementia and with no history of trauma, presenting to ED with altered mental status were included in the study.

Results: Out of 200 patients, 108 were male and 92 females. Patients having AMS because of poisoning, seizure, intracranial infection all had decreased mortality. Whereas patients having AMS because of stroke, infection, cardiovascular causes had significantly increased mortality. Season, sex, pH, SaO₂, TLC, GCS, mean Bp. were associated with increased mortality in patients of AMS presenting to emergency department. The logistic regression model was statistically significant (chi square=39.3, p=0.000). The model predicted 26% of the variance in predicting death and correctly classified 74.6% of patients.

Conclusions: The importance of being able to prognosticate AMS patients at outset in emergency is immense. Male sex, low mean BP, low GCS, low pH, low arterial SaO₂, and high TLC were predictive of higher death rate in this cohort of patients presenting to emergency department.

Keywords: Altered mental status, Prognosis, GCS, Outcome, Mean BP, PH

INTRODUCTION

Altered mental status (AMS) is a collective phrase describing the undifferentiated presentation of disorders of mentation, including impaired cognition, diminished attention, reduced awareness, and/or altered level of consciousness.¹ AMS may be found in 4% to 10% of ED.^{2,3} Certain patient subsets have higher rates of altered mentation, such as in the elderly; dementias and other delirious states are seen in up to 30% of the ED elderly.^{3,4} AMS is a common presentation in the ED yet is a

significant challenge to the emergency physician (EP) in that altered mentation does not suggest a specific diagnosis but rather a manifestation of a wide range of medical syndromes.⁵ Common causes of AMS in the ED patient include drugs (illicit and medicinal), infections, metabolic disarray, trauma, neoplasms, stroke convulsion, and a host of organ system dysfunctions.^{1,6,7} Mathematical scales like Glasgow coma scale (GCS) based on neurologic findings have been developed to define altered mentation.⁵ The prognosis seems to depend upon many diverse factors, like the etiology of AMS

patient, clinical variables and various laboratory tests.⁸⁻¹⁰ The aim of the study was to determine outcome in patients presenting with new onset AMS to emergency department in our population and further to look for various demographic, clinical and laboratory prognostic factors for death in our population.

METHODS

The study after getting cleared by ethics committee was conducted prospectively on random days in consecutive patients who came to Emergency Department ED of Sheri Kashmir institute of Medical sciences a tertiary care hospital in northern India. The cases were studied in two seasons. Winter group containing cases taken in December, January, February, and up till 21 March and non-winter group was from March 21 to August. The study was conducted from January 2015 to December 2016. Participants were patients with AMS prospectively diagnosed by emergency physician in emergency department.

Inclusion criteria

Emergency physician identified any one of the following criteria for the patient at the time of initial presentation: Glasgow coma scale score less than 15; patient not alert and not oriented to person, place, and/or time; difficult to arouse; unable to remain awake or conversant; hallucinations; confusion; bizarre or inappropriate behavior.

Exclusion criteria

Exclusion criteria were age less than 14, any obvious evidence of trauma, psychiatric disease, a known patient of dementia.

A proper history and a thorough examination was done by an emergency physician. Baseline investigations (complete blood count CBC, kidney function test KFT, blood sugar, blood gas and electrolytes, chest X-ray, ECG) were done routinely, CT scan head & CSF analysis were also done as and when indicated clinically. All other investigations needed to be done to establish a correct diagnosis were done. Patients were seen during the hospital stay till their discharge or death. Final diagnosis was established after a consensus. All these investigations and clinical setting established final diagnosis. Autopsy was not done.

Statistical analysis

The data was summarized using descriptive statistics such as mean, standard deviation and range. Chi square test was applied to compare the various demographic, clinical and laboratory variables in the two groups viz patients discharged alive and patients who died. Binary logistic regression was done to see the effect of various variables on the mortality in patients of AMS presenting

to emergency department. A two-sided p value less than 0.05 was considered statistically significant. Statistical analysis was done using IBM SPSS Statistics 25 software.

RESULTS

Out of 200 patients, 108 were male and 92 females. The average age (SD) was 57.56 years (17.37). One hundred twenty four patients were seen in non winter months and 76 were seen in winter months. The delay in presentation to emergency department was recorded and it varied considerably among various patients. Patients were grouped depending upon delay in presentation (Table 1). Depending upon the GCS the patients were grouped in three groups viz., <8, 8-11 and 12-15. The number of patients in these groups is shown in Table 1. Out of 200 patients 59 had focal neurological deficits while as rest had no focal deficit at the time of reception in ED. The various etiologic diagnosis (at the time of discharge or death) of the patients were grouped into 9 groups as shown in Table 2 and consisted of stroke, metabolic derangement, infection, cardiovascular, seizure, ICSOL, poisoning, intracranial infection and miscellaneous groups.

Table 1: Demographic and other characteristics of the cohort.

Variable	Frequency
Age (years)	57.56 (17.37) Min 15 max 100
Sex	Male 108
	Female 92
Delay in presentation (hours)	<6 hrs 33 (16.5%)
	6-11 hrs 52 (26%)
	12-24 hrs 59 (29.5%)
	>24 hrs 56 (28%)
Season	Non winter 124 (62%)
	Winter 76 (38%)
GCS	<8 39 (19.5)
	8-11 71 (35.5%)
	12-15 90 (45%)
Focal neurological deficit	Present 59
	Not present 141

On looking for the mortality, sixty patients died during hospital stay while as 140 were discharged alive. We compared various demographic, clinical and laboratory variables in the two groups viz., one group being patients discharged alive and another of those who died in hospital. The results are shown in the Table 3. There was no age difference in the two groups. Males had increased mortality than females 42 out of 108 vs. 18 out of 92 respectively. There were more deaths recorded in patients presenting in winter months than those presenting in non winter months (Table 2). Presence of diabetes mellitus, hypertension or history of similar events in past seemed to have no significant bearing on mortality (Table 3).

There was also no significant difference between the time delay in presentation in the two, groups. Presence or

absence of focal neurological deficit also had no statistically significant bearing on mortality.

Table 2: Number of patients in various diagnostic groups, gender distribution, seasonal distribution and mortality in each group.

Etiology		Male	Female	Non-winter	Winter	Death N (%)
CVA (57)	Alive	18	16	22	12	
	Dead	18	5	12	11	23 (41.4)
Metabolic (51)	Alive	18	22	23	17	
	Dead	7	4	4	7	11 (21.6)
Infection (17)	Alive	6	4	7	3	
	Dead	2	5	6	1	7 (41.2*)
Intra-cranial infection (15)	Alive	8	7	9	5	
	Dead	1	0	0	1	1 (6.7)
Seizure (13)	Alive	7	5	10	2	
	Dead	0	1	0	1	1 (7.7*)
Poisoning (11)	Alive	3	7	9	1	
	Dead	1	0	1	0	1 (9.1*)
ICSOL (10)	Alive	2	7	5	4	
	Dead	0	1	0	1	0 (0.0)
Cardiovascular (11)	Alive	–	–	–	–	
	Dead	9	0	4	5	9 (81.8)
SDH (7)	Alive	2	2	4	0	
	Dead	3	0	2	1	3 (42.9)
Miscellaneous (10)	Alive	3	4	–	–	
	Dead	1	2	1	2	3 (37.5)
Total (200)	Alive	66	74	94	46	
	Dead	42	18	30	30	60 (30.3)

*p value is significant (<0.05).

Table 2: Means/frequencies of various variables in two groups.

		Alive (n=140)	Dead (n=60)	P value
Sex	Male	66	42	0.003*
	Female	74	18	
Season	Non winter	94	30	0.026*
	Winter	46	30	
Diabetes mellitus	No	115	52	0.535
	Yes	25	8	
Hypertension	No	83	30	0.40
	Yes	57	30	
Similar episodes	No	119	51	0.80
	Yes	21	9	
Age		56.52 (16.96)	59.98 (18.20)	0.197
Age group (in years)	15-40	23	10	0.27
	40-60	32	8	
	>60	85	42	
Delay in presentation		34.57 (50.76)	30.57 (56.30)	0.624
Delay group	<6 hours	19	14	0.211
	6–11 hours	37	15	
	12-24 hours	45	14	
	>24 hours	39	17	
Mean BP (mmHg)		96.81 (25.08)	87.26 (41.81)	0.48
GCS		11.21 (2.80)	9.12 (3.30)	0.000*

Continued.

		Alive (n=140)	Dead (n=60)	P value
Focal neurological deficit	Present	101	40	0.269
	Absent	39	20	
pH		7.37 (0.09)	7.32 (0.15)	0.007*
PaO2		77.36 (15.0)	74.22 (21.04)	0.238
SaO2		92.44 (5.29)	89.20 (8.54)	0.001*
Hb		12.25 (2.29)	12.32 (2.87)	0.863
TLC		10.23 (3.67)	12.09 (6.43)	0.011*
Urea		58.95 (50.88)	64.85 (42.41)	0.432
Creatinine		1.64 (1.58)	1.94 (1.30)	0.201
Sodium		134.44 (9.27)	134.83 (9.27)	0.784
Potassium		3.67 (0.94)	4.00 (1.27)	0.042*
Sugar		130.10 (127.66)	121 (75.04)	0.646

Table 4: Showing GCS components individually as reliable indicators of outcome.

GCS components	Outcome survived (n=140)		Dead (n=60)		P value
	Mean	S. D	Mean	S.D	
E (eye response)	3.14	-	2.46	1.15	<0.0001
V (verbal response)	2.89	1.35	2.11	1.29	<0.0001
M (motor response)	5.21	1.12	4.48	1.48	<0.0001

Etiology of AMS had an immense impact on the mortality. Poisoning, seizure, intracranial infection had decreased mortality whereas stroke, infection, cardiovascular groups had significantly increased mortality. Patients were grouped on the basis of their GCS at the time of presentation into three groups <8, 8-12 and 12-15. The <8 group had 52.8% mortality 21(out of 39), 8-12 group had 33.3% mortality 24 (out of 72) and 12-15 group had 17.8% mortality 16 (out of 90).The individual components E, V, M were again seen to be individually having prognostic value (Table 4). Mean blood pressure was found to be low in the death group. Mean BP (SD) in alive and death group being 96 mmHG (25.08) and 87.26 mmHg (41.81) respectively. The various laboratory parameters which showed statistically significant association with mortality were pH, oxygen saturation of blood SaO₂, total leukocyte count and potassium as shown in Table 3. Though urea and creatinine levels were higher in death group but it did not reach to statistically significant level. The partial pressure of oxygen PaO₂ and sugar levels were higher; though statistically insignificant in alive group. The hemoglobin and sodium were similar in both groups.

Binary logistic regression was done to see the effect of various variables viz., sex, pH, SaO₂, TLC, GCS, mean Bp on the mortality in patients of AMS presenting to emergency department. The logistic regression model was statistically significant (chi square=39.3, p=0.000). The model predicted 26% of the variance in predicting death and correctly classified 74.6% of patients.

During hospital stay total of 22 patients (10.9%) had complications. The complications which occurred during hospital stay of the patients were aspiration pneumonia seen in 9 patients (37%), sepsis 7 patients (29.2%),

hyponatremia 4 patients (16%). Others complications like GI bleed, seizure, renal failure, re-bleed in SAH were seen in one patient each (4.2%). Some of the patients had more than one complication. There was no effect of hospital stay on the complication rate.

DISCUSSION

Of the 200 patients there were 60 deaths, the mortality being 30.0%. The etiology of AMS had an immense impact on the mortality. Poisoning, seizure, intracranial infection all had decreased mortality whereas stroke, infection; cardiovascular groups had significantly increased mortality in our cohort population. Similar prognosis vis a vis various diagnostic categories has been shown in other studies.¹¹⁻¹⁴ In one study by Abdullah et al poisoning has been shown to have increased mortality; contrary to our findings. This can be explained by the fact that most of our cases of poisoning were related to organophosphorus having a good antidote and hence it has very less mortality. In the study done by Abdullah worst prognosis was seen in undiagnosed patients, patients with viral encephalitis and poisoning and favorable outcome was seen in patients with electrolyte disturbance and diabetic ketoacidosis.¹⁵ Since the etiology of AMS varies geographically, hence the prognosis are like to vary as well. In the study done by Matuja et al in Tanzania good recovery was achieved in 42 (70%) with cerebral malaria.⁹ In our study, deaths were more in winter, 30 out of 76 patients i.e. 39.4% compared from non-winter 30 out of 124 i.e. 24.1%. There were two reasons for it. Firstly out of 11 poisoning cases; 10 were in non-winter months; and poisoning as group had no mortality in our cohort as shown in Table 1. Predominance of poisoning cases in non-winter months could be socioeconomic. Secondly strokes were relatively

more common in winter months and strokes as a group had increased mortality as discussed above.

Among clinical variables GCS and mean BP were found to be low in patients who died. The GCS was grouped in 3 groups <8, 8-12 and 12-15. The <8 group had 52.8% mortality 21 (out of 39) 8-12 had 33.3% mortality 24 (out of 72) and patients in 12-15 GCS group had 17.8% mortality 16 (out of 90). The individual components E, V, M were again seen to be individually having statistically significant prognostic value. GCS as a reliable predictor of outcome in AMS patients has been shown by other studies as well.^{9,14-17} Mean BP at presentation in the patients who died was 87 mmHg as compared to 96.77 mmHg in patients who survived. In a pediatric study in non-traumatic coma patients, hypotension, poor pulse volume at admission and after 48 hours were associated with 66% mortality.¹⁸ Similar observations have been made by Johnston et al in their study of nontraumatic coma done in pediatric age group.¹⁹ In a CardShock study mental status was assessed at presentation of shock in 215 adult cardiogenic shock patients.²⁰ They found that altered mental status was a common clinical sign of systemic hypoperfusion in cardiogenic shock and was associated with poor outcome. It was also associated with several biochemical findings that reflected inadequate tissue perfusion, of which low arterial pH is independently associated with altered mental status. Thus conversely patients presenting with AMS due to cardiovascular cause and having hypotension should have bad prognosis. In our study we found two things in this context. First out of 11 patients in cardiovascular group only 2 survived. Second hypotension and lower mean BP were associated with increased mortality.

In our study laboratory factors shown to have prognostic value were pH, potassium, SaO₂, TLC. Total leukocyte count was related to death positively. This could be explained by increased TLC related to stress state and comorbid infections. Low pH was also associated with increased mortality. The explanation could be that, increased mortality in circulatory collapse as discussed supra vide, which is usually associated with lactic acidosis. And associated comorbid renal failure also led to increased mortality. Decreased oxygen saturation (SaO₂) was again associated with increased mortality mean SaO₂ in death group being 89.28 (CF from 92.4 in alive group) minimum value 47 in death group (CF 66 in alive group). High potassium was again related to mortality directly, this could be explained by increased mortality in patients with comorbid renal failure, as renal failure was number one comorbid condition seen in our patients. In a Turkish study which aimed to study the frequency and etiology of altered mental status in adults at an emergency department found that blood glucose, AST, ALT, LDH, and CKMB levels were found to be significantly higher in patients who died; though prognostication was not their primary objective, but this does point out that biochemical parameters can be

explored as prognostic indicators in patients with altered mental status.²¹

Some variables which intuitively would seem to be having effect on the prognosis were not found statistically doing so. Increased age was not related to higher mortality; the mean age (SD) in the alive and death group, being 56.53 (16.96) years and 59.98 (18.20) years respectively. Even though there was a trend towards higher mortality in older patients on doing subgroup analysis (Table 3). The delay in presenting was not translated into increased mortality. There are two reasons for it. First our cohort was not a homogenous group as regarding the etiology and hence the effect of delay in treatment by hours may not affected some diseases e.g., SDH, ICSOL, metabolic encephalopathy. Second our cohort had a high number of stroke which itself had higher mortality (Table 2). Thus patients developing sudden AMS because of stroke usually intracranial hemorrhage would reach the emergency department quickly because of more dramatic onset of illness but even then end up having higher mortality because of higher mortality of the disease per se. In an African study done on coma patients (GCS <8) delay in presentation of more than 6 hours translated into increased mortality.²² The difference between our study is that in our study inclusion criteria was GCS <15; hence patient profile was different. Moreover as alluded above, stroke constituted 29% of the patients; the above mentioned African study did not mention the etiology of coma so it is difficult to compare this aspect.

CONCLUSION

The importance of being able to prognosticate AMS patients at outset in emergency is immense. Male sex, low mean BP, low GCS, low pH, low arterial SaO₂, and high TLC are predictive of higher death rate in this cohort of patients presenting to emergency department. This data is available usually in short time to the emergency physician. On applying this model one can identify patients having chance of mortality and thereby give appropriate attention to these patients to decrease their mortality.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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