

## STUDY OF AETIOLOGY AND CLINICAL OUTCOMES IN COMA PATIENTS WITH NORMAL BRAIN CT SCAN

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### ABSTRACT

#### BACKGROUND

Coma is one of the common problems with which patients get admitted into the emergency department. Coma is a state of unconsciousness from which the patient cannot be awakened; it indicates either structural or functional abnormalities in the reticular activating system. In a significant number of cases CT scan can be normal if the coma is due to toxic or infections or metabolic abnormalities.

Aim: The present study was undertaken to study the profile of coma patients with normal CT scan brain with respect to aetiology, coma scale and prognosis.

#### MATERIALS AND METHODS

It is a prospective observational study. 120 cases of coma patients with normal CT Brain admitted into the acute medical care unit, King George Hospital, Visakhapatnam were studied (from October 2006 to October 2008).

#### RESULTS

Of the 120 patients, males (57.5%) were found to be more common. Toxic causes (of which alcohol intoxication) and infectious aetiology (of which cerebral malaria) accounted for 75% of cases. Glasgow coma scale and duration of coma with respect to the prognosis were studied.

#### CONCLUSION

Coma with normal CT scan brain was more common in males. Majority of cases were due to toxic or infectious causes and metabolic causes are other common causes. Increased mortality was noted in uraemic encephalopathy, advanced age group, Glasgow coma scale 5 or less or duration of coma is more.

#### KEY WORDS

Coma, CT Scan, Reticular Activating System, Metabolic Causes, Glasgow Coma Scale.

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#### BACKGROUND

Coma is one of the common neurological problems encountered in the emergency department. Since it implies severe central nervous system dysfunction, there is need to evaluate it quickly and thoroughly to protect brain against serious irreversible damage. Coma is a state of unconsciousness in which a person cannot be awakened; fails to respond normally to painful stimuli, light or sound; lacks a normal wake-sleep cycle; and does not initiate voluntary actions.<sup>1</sup> Consciousness is the condition of normal awake individual, of which the content of consciousness is determined by cerebral hemispheres and the thalamus and the state of consciousness is determined by the ascending reticular activating system in the brainstem, both structural or functional of the structures produce coma.<sup>2</sup> Despite the best treatment, only 15% of patients with unconsciousness from no traumatic causes make recovery.<sup>3</sup> Glasgow Coma Scale is a very popular and integral part of management of coma patients, which is used to assess the severity of coma.

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The scale was described in 1974 by Graham Teasdale and Bryan Jennett as a way to communicate about the level of consciousness of patients with an acute brain injury.<sup>4</sup>

#### Glasgow Coma Scale

GCS score= E + M + V.

#### Eye Opening Scores

- 4: Spontaneously.
- 3: To verbal command.
- 2: To pain.
- 1: No response.

#### Best Motor Response Scores

- 6: Obeys command.
- 5: Localises pain.
- 4: Flexion withdrawal.
- 3: Flexion abnormal (Decorticate).
- 2: Extension (Decerebrate).
- 1: No response.

#### Best Verbal Response Scores

- 5: Oriented and converses.
- 4: Disoriented and converses.
- 3: Inappropriate words; cries.
- 2: Incomprehensible sounds.



- 1: No response.
- Mild: 13 - 15 points.
- Moderate: 9 - 12 points.
- Severe: 3 - 8 points. Coma patients have scores less than 8.

### **Coma is produced by one of the two Broad Groups of Problems**

1. Structural abnormalities of upper brain stem and lower diencephalon or more widespread changes in both cerebral hemispheres.
2. Non-structural, sub-microscopic changes secondary to metabolic abnormalities, toxic or infectious causes.

The former group is associated with abnormalities in imaging like CT scan, whereas in the second group gross structural imaging like CT scan brain. Coma secondary to non-structural causes constitutes an important cause of coma accounting for majority of cases.<sup>5</sup> In a study by O Keefe et al in patients with altered mental status, non-structural causes accounted for 65% and structural causes 33% and psychiatric cause in 2%. In the study by Plum and Posner of 500 patients of 326 (65%) were because of metabolic and other diffuse disorders.

### **The Characteristics of Coma Patients with Normal CT Scan Brain when compared to those with Structural Abnormality-**

1. Confusion and stupor commonly precede motor signs.
2. Motor signs are usually symmetrical.
3. Pupillary reactions are preserved, except in specific poisons altering pupils.
4. Asterixis, myoclonus, tremor and seizures are common.
5. Acid base imbalance, hyper or hypoventilation is frequent.
6. Asymmetric ocular movements are uncommon, if present indicate structural causes.
7. Muscle tone is usually symmetric and normal or decreased in metabolic coma, whereas asymmetrical tone is seen in structural causes.

### **Aim**

To study the aetiology and clinical profile, outcome and the prognostic factors of patients admitted with coma, with normal CT scan brain, attending the emergency department in King George Hospital, Visakhapatnam.

### **MATERIALS AND METHODS**

It is a prospective observational study, 120 cases of coma patients with normal CT Brain admitted into the acute medical care unit, King George Hospital, Visakhapatnam were studied (from October 2006 to October 2008).

### **Inclusion Criteria**

1. Patients presenting with loss of consciousness of more than 6 hours duration.
2. Glasgow coma scale < 8 at admission.
3. Normal CT scan brain.

### **Criteria for Normal CT Scan Brain are-**

- Cerebral parenchyma should show normal grey and white matter differentiation and there should be no space occupying lesion.

- Posterior fossa and fourth ventricle should be normal in size and structure.
- Ventricular system and cisterns should be normal in size and pattern.
- No extra axial collection of blood, fluid.
- Skull vault and soft tissues should appear normal.

### **Exclusion Criteria**

1. Patients with head injury.
2. Abnormal CT scan brain.
3. Patients with stroke (CVA).

A detailed history was taken and evaluation was done to identify the cause of coma. Level of consciousness is defined by Glasgow coma scale. CT scan was done in all these patients. Investigations like complete blood counts, ESR, renal function tests like serum creatinine, blood urea, liver function tests and serum electrolytes were done. Patients were followed till their recovery, discharge from the hospital or death. The outcome was recorded as survived or dead. Among the survivors it was further graded as good recovery, moderate disability or severe disability or persistent vegetative state.

### **Good Recovery**

Patients who regained the ability to conduct a normal life or if a pre-existing debility exists, to resume the previous level of activity.

### **Moderate Disability**

Patients who achieve independence in activities of daily living, but retain physical or mental limitations that preclude them to resume previous level of function.

### **Severe Disability**

Patients who regained some cognitive function, but depend on others for daily support.

### **Vegetative State**

Patients who are awaken, but give no signs of cognitive awareness.

### **No Recovery**

Patients who remain in coma till death.

### **Statistical Analysis**

Analysis were done by using chi-square test wherever applicable. P value < 0.05 was taken as significant. Statistical analysis is done by using XL Stat software.

### **RESULTS**

In the present study of 120 patients 69 patients (57.5%) were males and 51 (42.5%) were females. Of them, 16 (23.19%) males died and 13 (25.49%) female patients died.

Results were analysed with XL Stat software. Results were expressed in mean +/- standard deviation. P value <0.05 was taken as significant.

Glasgow coma scale is a significant predictor of mortality. It is inversely proportional to the mortality. There is 100% mortality in patients of GCS of 3, whereas mortality is 93.75% in patients with GCS of 6 and 93.57% in patients of GCS 7.

$$X^2 (\text{X square}) = 21.34, p= 0.0001 \text{ (p} < 0.005 \text{ significant)}$$

In the present study, Glasgow coma score is a significant predictor of mortality. The score is inversely proportional to mortality,  $p < 0.0001$ .

### Age Distribution

Age Group	No. of Pts.	%	No. of Pts. Dead	%
12-20	17	14.6	3	17.64
21-30	30	25	8	22.66
31-40	21	17.5	2	9.52
41-50	27	22.5	7	25.93
51-60	16	13.33	4	25
61-70	07	5.85	3	42.86
71-80	02	1.66	2	100

**Table 1. Age distribution in the Present Study**

Age distribution in the present study was as shown in the above table. Coma was seen most commonly in 21 - 20 years' age group. Increased age is associated with increased mortality.

Aetiology of coma: In the present study, the aetiology of coma was found to be as follows.

Aetiology		No. of Patients	(%)	No. of Patients Dead	Mortality (%)
<b>Toxic</b>					
	Poisoning	9	7.5	1	11.11
	Alcohol intoxication	20	16.66	0	0
<b>Infections</b>					
	Cerebral malaria	34	28.33	8	23.5
	TB meningitis	10	8.33	2	20
	Encephalitis	2	1.66	1	50
<b>Metabolic</b>					
	Hypoglycaemia	2	1.66	0	0
	Hyponatraemia	5	4.16	1	20
	DKA	1	0.83	0	0
	Hepatic encephalopathy	10	8.33	4	40
	Uraemic encephalopathy	7	5.83	6	85.77
<b>Miscellaneous</b>					
	HTN encephalopathy	4	3.33	1	25
	Postictal coma	8	6.66	0	0
	Hypoxic encephalopathy	4	3.33	3	75
	Septic encephalopathy	4	3.33	2	50
<b>Total</b>		<b>120</b>		<b>29</b>	

**Table 2. Aetiology of Coma with Normal CT Scan in the Present Study**

In the present study alcohol intoxication, cerebral malaria was found to be the commonest cause of coma with normal CT scan brain.

Mortality with respect to risk factors when mortality of the patients was analysed with respect to the risk factors results were as follows.

Risk Factor	No. of Cases	No. of Pts. Dead	Mortality Percentage
HTN	20	6	30
Diabetes	6	4	66.66
HTN +Diabetes	15	6	40
Smoking	30	9	18

**Table 3. Mortality with respect to the Risk Factors in the Present Study**

When mortality in the present study was analysed with respect to Glasgow coma scale, the results were as follows:

GCS Score	No. of Pts.	%	No. of Deaths	%
3	1	0.83	1	100
4	10	8.33	9	90
5	21	17.5	14	66.66
6	32	26.66	3	9.375
7	56	46.66	2	3.57

**Table 4. Glasgow Coma Scale at admission with respect to Prognosis**

Low Glasgow coma scale was associated with increased mortality, increasing drastically if the value is 5 or less.

When the duration of coma with respect to prognosis was analysed, the results were as follows:

No. of Days in Coma	No. of Pts.	No. of Pts. Dead	No. of Pts. Recovered	Mortality
1	13	0	13	0
2	22	0	22	0
3	20	1	19	5
4	15	4	11	26.66
5	17	7	10	41.17
6	11	4	7	36.36
7	3	1	2	33.33
8	8	5	3	62.5
9	1	1	0	100
10	5	3	2	60
11	1	1	0	100
12	2	1	1	50
13	1	0	1	0
14	1	1	0	100
	120	29	81	

**Table 5. Duration of Coma with respect to Prognosis**

All patients with duration of coma less than 2 days, recovered completely. As the duration of coma increased, mortality raises.

Outcome: In the present study of 120 patients, 29 (24.6%) patients died and 91 patients (75.83%) recovered. Among the recovered patients 83 (91.2%) patients had good functional recovery, 7 (7.69%) patients were left with moderate disability and 1 (1.09%) patient was left with severe disability.

### DISCUSSION

In the present study of 120 patients with coma with normal CT scan brain, most of the patients were in 3<sup>rd</sup> decade 25%. Male preponderance was observed in 57.5% compared to females 42.5%. In the present study the aetiology of coma with normal CT scan brain, infectious aetiology, metabolic causes and toxic causes accounted for 38.33%, 37.5% and 24.16% respectively. In the study by Plum and Posner et al (1981), toxic and metabolic causes were found to be more

common 45.7% and 42.38% respectively and infections accounted for 4.29%. In the study by Grmec et al (2001), toxic causes were found to be the commonest in 44.8% and metabolic and infectious causes accounted for 20.51% and 20.51% in each respectively.

Infections and metabolic causes were similarly reported in both sexes. Cerebral malaria was the commonest cause of coma in 31.66% followed by alcohol intoxication in 16.66%. Mortality is about 23 - 25%, similar in both sexes. As the patient's age increased, raise in the mortality was noted. Mortality was highest in 71 - 80 years' patient group, similar to the study by Grmec et al in 2001 where the patients who died were older than who survived ( $66.8 \pm 11.1$  years versus  $46.1 \pm 15.4$  years,  $p < 0.005$ ).<sup>6</sup>

Highest mortality is seen in metabolic coma and lowest mortality was seen in coma due to toxic causes. Of metabolic coma uraemic encephalopathy is associated with highest mortality, 85.77% followed by hypoxic encephalopathy and 75%. In coma secondary to alcohol intoxication, diabetes ketoacidosis, hypoglycaemia and postictal coma, all patients survived.

Diabetic patients have 66.6% mortality and hypertensive patients 40% mortality.

Glasgow coma scale was a significant predictor of mortality with an inverse relation ( $p < 0.0001$ ). In our study we found that in patients with less Glasgow coma scale 7, mortality was seen in 3.75%, whereas mortality raised steeply if the Glasgow coma scale is 5 or less. Similar findings were observed in other studies.

The duration of coma was also found to be associated with prognosis. In patients with coma of less than 2 days duration, all patients survived. As the duration of coma increased, rise in mortality was noted.

In our study overall mortality noted was 24.16%, is much less when compared to other studies. The reason might be because the studies were done earlier as more sophisticated investigations and effective treatments are available now. Cerebral malaria and alcohol intoxication were seen in majority of our cases, which are potentially treatable.

Outcome	Plum and Posner et al	Levy et al	Sharma et al <sup>7</sup>	Thacker et al <sup>8</sup>	Present Study
Death	61%	61%	80%	50%	24.16%
Recovery	39%	39%	20%	50%	75.83%

**Table 6. Overall Mortality in Comparison with Other Studies**

## CONCLUSION

In patients of coma with normal CT scan brain, male (57.51%) preponderance was noted. Metabolic causes (37.5%) and infections (38.3%) accounted for about 75% of all cases of coma with normal CT brain in the present study. Cerebral malaria (31.66%) accounted for majority of infectious causes. Highest mortality is seen in metabolic coma (37.78%), of which uraemic encephalopathy (85.77%) accounted for majority of the cases. Glasgow coma scale at admission and duration of coma are good predictors of prognosis and outcome.

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