

# Clinical profile of children presenting with non-traumatic coma

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## Abstract

**Background:** Non-traumatic coma (NTC) in childhood is a pediatric emergency and accounts for high morbidity and mortality. Aim of this study is to establish the common causes of the Non traumatic Coma amongst the children and establish the correlation between various factors contributing to the subject condition. **Methods:** An observational prospective study was conducted over a period of 1 year. Children aged 9 months to 12 years with Non Traumatic Coma were studied and followed upto discharge or death. A complete history, general and systemic examination at presentation was recorded. Relevant laboratory and radiological investigations were performed and Glasgow Coma Scale(GCS) Score was recorded. Etiology of coma was determined on the basis of history, clinical examination and investigations. **Results:** Total 60 patients with NTC were studied. The maximum number of patients were seen in the age group of 1-3 years i.e toddlers. Central Nervous System infections were the leading cause accounting for 50% of the cases. Simple clinical signs such as hypotension, hypothermia, abnormal respiratory pattern, abnormal pupillary reaction were significantly associated with poor outcome. Survival was better with Central nervous System infections as compared to poisoning. GCS score of less than 5 was significantly associated with high mortality. Mortality in this study was found to be 18.3%. **Conclusion:** Simple clinical signs such as hypothermia, hypotension, abnormal pupillary reaction, abnormal breathing pattern and decerebrate posturing are good predictors of morbidity and mortality in NTC. Knowledge and application of GCS on admission can predict mortality.

**Key Words:** Central Nervous System infections, Glasgow coma Scale, Morbidity, Non-traumatic coma, Prospective study

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## INTRODUCTION

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. According to

Glasgow coma scale, coma is defined as GCS less than or equal to 8<sup>1</sup>. Condition of coma can be classified mainly as traumatic and non-traumatic coma. Childhood coma is a non-specific consequence of a variety of serious pathological processes. Most epidemiological studies of coma in children have concentrated on traumatic coma. However non-traumatic coma (NTC) in children is also a common cause of admission in pediatric emergency department and is reported to carry a high morbidity and mortality<sup>2</sup>. These children make heavy demands on pediatric intensive care unit and neuro-rehabilitation resources. Non-Traumatic Coma is a non-specific sign with a wide potential for differential diagnosis and considerable expertise, good clinical acumen and advanced laboratory support is needed to reach to a correct diagnosis and manage every case properly. Simple clinical signs are often good predictors of outcome<sup>3,4</sup>. In a developing

country like India where the medical facilities are scarce and large junk of population is deprived of the medical attention, very little information exists on the etiological factors contributing to the condition of non-traumatic coma among the children in the age group of 9 months to 12 years. High mortality rate among the children in this age group is a cause of concern and needs serious efforts to manage the condition of non-traumatic coma. Aim of this study is to establish the common causes of the non-traumatic coma amongst the children based on the profile of the children presenting with the symptoms of non-traumatic coma and establish the correlation between various factors contributing the subject condition. It is expected to help in timely and appropriate management of children presenting in hospitals with basic health facilities within 24 hours of admission, the crucial time when most children with acute encephalopathies die in this setting. Referral to high level facilities can follow thereafter if necessary.

## MATERIALS AND METHODS

**Study design-** Hospital based prospective observational study.

**Study setting-** Pediatric wards of tertiary care hospital in central India.

**Study population-** Children in the age group, of 9 months-12 years presenting with non- traumatic coma (GCS  $\leq$ 8) in Pediatric wards of tertiary care hospital.

**Sample Size –**

Pilot study was conducted for 2 month before taking up the study in the same hospital which showed average of 5 patients per month presenting with non- traumatic coma in the Pediatric wards so sample size was calculated accordingly as 60 for the duration of study which is 1 year.

**Sampling Technique –**

As number of patients presenting with non- traumatic coma in pediatric wards are very less, all the patients presenting with non-traumatic coma in the study duration satisfying the inclusion criteria were taken for the study.

**Inclusion Criteria:**

1. All children admitted to hospital in pediatric wards with non-traumatic coma (GCS  $\leq$ 8) from 1<sup>st</sup> March 2018 to 28 February 2019.
2. Age Between 9 months to 12 years.

**Exclusion Criteria**

1. Children below the age of 9 months and above 12 years shall be excluded from this study
2. Children presenting with traumatic coma shall be excluded from the study.

**Data Collection Procedure –**

Primary data was collected form the case history of the children admitted with non-traumatic coma condition with GCS  $\leq$ 8. GCS sore was used to define coma. Collected data

was recorded systematically in a format pre-decided for this purpose to cover all necessary inputs required for the analysis of etiological factors of non-traumatic coma among the children. Patients were re-examined at discharge to record outcome. Clinical variables like heart rate, respiratory rate and pattern , blood pressure, temperature, coma severity (using modified Glasgow coma scale%[5]), pupillary size and response to light, extra ocular movements and fundus examination findings were recorded. Etiology of coma was determined on the basis of history, clinical examination and relevant laboratory investigations. The investigations such as lumbar puncture, CT scan and metabolic work up were planned and determined by the clinical presentation and carried out. Standard basic investigations like Immediate blood glucose by reagent strips ,complete blood count, serum electrolytes liver function test, renal function test, Urine for reducing sugars and ketones ,Blood and urine cultures, peripheral smear and rapid diagnostic test for malarial parasite was obtained.

**Data management and analysis**

The data was entered in Microsoft excel sheet and analyzed using Statistical package for social studies (SPSS) software version 20. The results were expressed in frequencies and proportions. Appropriate statistical tests like chi square test , fisher's exact test and Z test of proportions were used. p value of  $<0.05$  will be considered significant.

**Operational definitions:**

Non-Traumatic Coma was defined as Glasgow Coma Scale score of  $\leq$  8 without any preceding history or any evidence of trauma.

**Tachycardia**[6] – Heart rate above the upper limit for that age.

**Bradycardia**[6] – Heart rate less than lower limit for that age.

**Hypertension** – Blood pressure more than 95<sup>th</sup> centile for age and sex.

**Hypotension** – Blood pressure below 5<sup>th</sup> centile for age and sex.

**Hyperthermia** – Axillary temperature above 38 C

**Hypothermia** – Axillary temperature below 35 C

**Pupils** - i) normal – both pupils equal in size, 2-3mm in diameter and reactive to light, ii) abnormal – pupils small (=1mm), or dilated (=4mm), unequal or non-reactive to light

**Extra ocular movements-** i) normal- no impairment of movement in any direction, ii) abnormal – if lateral, medial, upward, downward or all movements of eyeballs were absent.

**Corneal reflex-** absent or present

**Respiratory pattern** was said to be abnormal if the breathing was central neurogenic hyperventilation, apneustic, ataxic or apneic

**OBSERVATIONS AND RESULTS**

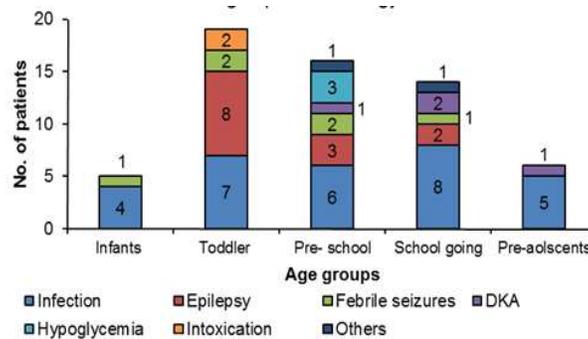
There were 6000 admissions in pediatric wards during the study period and out of which 60 children were admitted with Non-traumatic Coma (NTC), thus the incidence of non-traumatic coma was 1% i.e. 10 per 1000.

Majority of the cases were toddlers (31.66%), followed by preschool (26.6%), school going (23.3%), preadolescents (10%), and infants (8.3%). Males predominated the study with M:F ratio being 1.6:1.(Table 1)

**Table 1: Age and sex distribution of cases**

Age group	No of cases	Male	Female	Percentage
Infants (<1 year)	05	03	02	08.33%
Toddlers (>1-≤3years)	19	11	08	31.66%
Preschool (>3-≤6years)	16	10	06	26.66%
School going (>6-≤10 years)	14	10	04	23.33%
Preadolescents (>10-≤12 years)	6	03	03	10.00%
<b>Total</b>	<b>60</b>	<b>37(61.6%)</b>	<b>23(38.3%)</b>	<b>100%</b>

Amongst 60 cases of NTC, 85%(51) presented with convulsion as the main complaint which was followed by fever 65% (39), altered sensorium 60% (36), vomiting 33.3% (20), headache 15%(9) and icterus 1.6%(Fig 1)



**Figure 1: Stacked bar chart showing number of patients as per age and etiology**

While going through the age specific etiology, it was found that amongst infants, CNS infection was the commonest underlying etiology (80%). In toddlers most common etiology was seizure disorder (42.1%), followed by CNS infections (38.8%). In the preschool, school going and pre-adolescent age group CNS infection was the commonest etiology. Overall in 50% Non-traumatic Coma cases the etiology was infective in nature. Encephalitis was the most common etiology amongst the cases constituting 26.6%, followed by meningitis(21.66%) and seizure disorder(21.66%). Other etiologies were febrile seizures (10%), diabetic ketoacidosis (6.66%), hypoglycemic seizures (5%), poisoning(3.33%), hepatic encephalopathy (1.66%), and hypertensive encephalopathy (1.66%).(Table 2)

**Table 2: Diagnosis in Non-Traumatic Coma**

Diagnosis	No. of cases	Percentage
Encephalitis	16	26.66%
Meningitis	13	21.66%
Seizure disorder	13	21.66%
Febrile seizures	6	10.00%
Diabetic ketoacidosis	4	06.66%
Hypoglycemic seizures	3	05.00%
Poisoning	2	03.33%
Hepatic encephalopathy	1	01.66%
TB meningitis	1	01.66%
Hypertensive encephalopathy	1	01.66%
<b>Total</b>	<b>60</b>	<b>100%</b>

All the clinical findings observed in NTC had significant p value using chi square test. This indicates that if these findings are present in the patient of NTC on admission, the probability of mortality is more (Table 3).

**Table 3: Clinical parameters and outcome in NTC**

Parameter	Outcome			P value*
	n	Survived	Expired	
Hypothermia	5	2 (40%)	3 (60%)	0.012
Hypotension	19	12 (63.1%)	7 (36.8%)	<0.0001
Abnormal breathing pattern	12	5 (41.6%)	7 (58.3%)	0.0002
Abnormal pupillary reaction	10	0	10 (100%)	<0.0001
Decerebrate posturing	8	0	8 (100%)	<0.0001

\*using chi square test, p value <0.05 is significant

Table no. 4 shows the number of survivals and deaths according to diagnosis. The proportion of survivals and deaths for CNS infections and seizure disorder were insignificant as indicated by p-values 0.739 and 0.617 respectively using Fisher’s exact test. Poisoning was significantly associated with the poor outcome and the p value was 0.035.

**Table 4: Etiology and outcome in Non- Traumatic Coma**

Parameter	Outcome			P value*
	Total (n=60)	Survived (n=48)	Expired (n=11)	
CNS Infections	30	24 (80%)	6 (20%)	0.739
Seizure disorder	13	10 (76.9%)	3 (23%)	0.617
Poisoning	2	0 (0%)	2 (100%)	0.035
Others	15	15 (100%)	0 (0%)	0.034

\*Using Fisher’s exact test, p value <0.05 is significant

On studying the patient of NTC for morbidity, it was seen that decerebrate posturing was the most common finding accounting for 13.3%, followed by 7<sup>th</sup> nerve palsy (5%). However, other morbidities like hearing defects, speech problems, cognitive defects, behavioral problems were not found in the present study. The outcomes differed significantly between two GCS categories (3-5 and 6-8) as indicated by a p-value < 0.0001 using Z-test of proportions. This shows that GCS score of 3-5 on admission is associated with poor outcome and high mortality as compared to patients having GCS score between 6-8 (Table 5).

**Table 5: Comparison of mortality according to GCS score categories**

GCS Score	No. of patients	No of patients died	P value*
3-5	10	09 (90%)	< 0.0001 (S)
6-8	50	02 (4%)	
<b>Total</b>	<b>60</b>	<b>11</b>	

S= significant, \*Using Z test of proportions

There were 11 deaths out of 60 NTC cases, out of which 6 cases were due to CNS infection, 3 of seizure disorder and 2 patients of poisoning. Thus the mortality in the present study was 18.33%

## DISCUSSION

The incidence of NTC in present study was 1% i.e. 10 per 1000. Very few studies are available on the incidence of NTC. According to the study by Wong CP<sup>3</sup> in Northern NHS region of UK, in 2001, the incidence of Non-traumatic Coma was 30.8 per 100 000 children under 16 per year i.e. 0.03% which is very less as compared to the present study. India being the developing country and holds major burden of global population with majority of people living below poverty line and thus are deprived of basic facilities including education and health care, incidence of CNS infections accounting for NTC is more which may be responsible for the increased incidence of NTC in present study. In the present study, toddlers i.e. 1-3yrs were found to have greater incidence of NTC (31%) followed by preschool (26%). Similar results were

obtained by Prabha *et al.*(2003)<sup>7</sup>. Whereas in the study by Arun Bansal *et al.* (2005)<sup>8</sup>, maximum number of patients were in the age group of 4-5years. Males predominates the present study with M:F ratio of 1.6:1.(Table 1). In the study by Ahmed *et al.*(2015)<sup>9</sup>, M:F ratio was 1.2:1, while Buch Pankaj *et al.*(2011)<sup>10</sup> had M:F ratio of 0.88:1 with females predominating . Thus showing that there is no fixed male or female predominance in the occurrence of Non-traumatic Coma cases. Majority of the patients (85%) presented with convulsions as a manifestation of Non-traumatic coma . However, in a study by Wong CP (2001)<sup>3</sup>, the most common presenting symptom was altered level of consciousness (13.2%) followed by vomiting (10.3%) and convulsions (9.4%). In developing world due to lack of awareness about consciousness the parents might have brought the children after more severe symptom like

convulsions developed. While going through the age specific etiology, it was found that amongst infants, CNS infection was the underlying etiology in 80% of the cases. In toddlers most common etiology was seizure disorder (42.1%), followed by CNS infections (38.8%). In the preschool, school going and pre-adolescent age group CNS infection was the commonest etiology. Overall in 50% Non-traumatic Coma cases the etiology was infective in nature (Fig 1). In this study, CNS infection accounted for almost 50%, thus establishing infective cause as predominant one. This is also supported by other studies by Vijaykumar *et al.*<sup>11</sup> (50%), Ogun Mekan *et al.*<sup>12</sup> (41.8%), Seshi *et al.*<sup>13</sup>(34.7%) sofiah *et al.*<sup>14</sup>(69%), where infections of CNS were found to be the leading cause of Non-Traumatic coma in children. (Table 2) The vital parameters on admission which were significantly associated with outcome in this study were hypothermia, hypotension, abnormal breathing pattern, abnormal pupillary reaction and decerebrate posturing all of which were associated with poor outcome and high mortality with p-values of <0.05 (Table 3). This is also supported by other studies like Ahmed *et al.* (2015)<sup>8</sup> in which abnormal respiratory pattern, abnormal pupils, absent corneal reflex, abnormal extra-ocular movements, and papilledema on admission correlated significantly with mortality. Buch Pankaj *et al.* (2011)<sup>10</sup> also concluded that shock on presentation, hypothermia, abnormal breathing pattern, non-reactive pupils correlated significantly with mortality. The outcome of coma was dependent on the etiology (Table 5). CNS infections showed highest incidence and good survival rate as compared to those with poisoning. This correlates with the findings of Wong CP *et al.*<sup>3</sup>, Ikhlas Ahmed *et al.*<sup>9</sup> who have concluded that outcome of coma was dependent on the etiology. They also found that mortality was higher in cases of toxic metabolic coma followed by CNS infections and status epilepticus. Ikhlas Ahmed *et al.*<sup>9</sup> is of opinion that survival was better in patients with CNS infection as compared to toxic metabolic causes and IC bleed. According to Arun Bansal *et al.*<sup>8</sup> (2005), survival was significantly better in patients with CNS infections (63%) as compared to those with toxic metabolic causes (27%). However, Saba Ahmed *et al.* (2011) concluded that infections were the leading cause of non-traumatic coma as well as the leading cause of mortality<sup>15</sup>. GCS score on admission was an important independent predictor of outcome in the present series. GCS score of less than 5 on admission was significantly associated with poor outcome and high mortality (Table 5). This is also supported by Sacco RL *et al.*<sup>16</sup>, in the year (1988) concluded that patients with initial GCS score of 6-8 were seven times more likely to awaken than those of scores 3-5. In a study at Wardha by Chaturvedi P and Kishore M (2001)<sup>17</sup>, it is concluded that children with

MGCS scores of less than 5 on admission have the worst prognosis and a very high probability of death. The mortality in this study was 18.3%. This is comparable with the mortality rates in other studies like Vijay Kumar *et al.* (2003)<sup>11</sup> with mortality of 12% and Ogunmekar *et al.*<sup>12</sup> (26.7%). While the other studies showed significantly high mortality as compared to the present study like Wong CP (45.6%)<sup>3</sup>, Ahmed *et al.* (33.9%)<sup>9</sup>, Buch Pankaj *et al.* (59.5%)<sup>10</sup> and Arun Bansal *et al.* (35%)<sup>8</sup>. The higher mortality rates in these studies was possibly due to presentation later in the natural history of disease.

## CONCLUSION

Thus to conclude, out of 100 admissions 1 is likely to get admitted with NTC, 50% of them are likely to be because of CNS infections as a cause of NTC. The present study shows that simple clinical signs such as hypothermia, hypotension, abnormal pupillary reaction, abnormal breathing pattern and decerebrate posturing were strong predictors of morbidity and mortality following NTC. The study also reaffirms that clinical variables and GCS score remains the most readily available tools for assessment of non-traumatic coma to identify those who are likely to die and those having greatest potential for recovery. This is particularly helpful in resource limited countries for directing the limited resources for maximum benefit.

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