Original Article

Intracranial Infections in Children

Frequencies of Common Intracranial Infections Leading to Coma in Children

Anila Farhat and Sohail Babar

ABSTRACT

Objective: The present study was carried out to find the frequencies of common intracranial infections like tuberculous meningitis, bacterial meningitis and viral encephalitis in children presented with coma.

Study Design: Descriptive / cross-sectional study

Place and Duration of Study: This study was conducted at the Department of Pediatrics, Benazir Bhutoo Shaheed Hospital Abbottabad from April 2016 to July 2017.

Materials and Methods: With the approval from hospital ethical committee, 92 patients of either gender with intracranial infections presented with coma were included in the study. Details of history, clinical examination at the time of admission and clinical variables were recorded on a structured proforma. Data was entered and analyzed in SPS version 17. Mean and standard deviation were calculated for quantitative variable like age whereas for categorical variables like temperature, fits, acute onset of illness, BCG scar, neck stiffness, papilledema, corneal reflex and pupillary reaction, percentages and frequencies were calculated.

Results: In the study population, male patients predominate with a total of 68.5% patients while 31.5% patients were female. Frequencies of bacterial meningitis, viral encephalitis and tuberculous meningitis were 44.6%, 31.5% and 23.9% respectively in the patients presented with coma. The study showed that the percentage of patients presented with different clinical variables, that is, temperature more than 100°F, fits, neck stiffness, BCG scar and papilledema were 88%, 72.8%, 68.5%, 41.3%, and 37% respectively.30.4% of patients presented with coma with in 48hrs of onset of acute illness. Pupillary and corneal reflex were absent in 18.5% and 20.7% patients respectively.

Conclusion: Amongst intracranial infections in patients presented with coma, frequency of bacterial meningitis was highest followed by viral encephalitis and tuberculous meningitis.

Key Words: Intracranial infection, coma, bacterial meningitis, viral encephalitis, tuberculous meningitis

Citation of article: Farhat A, Babar S. Frequencies of Common Intracranial Infections Leading to Coma in Children. Med Forum 2017;28(11):32-36.

INTRODUCTION

Coma is defined as a pathological state of deep and sustained (>1 hour) unconsciousness, distinguishable from normal sleep by the inability to be aroused. It can also be considered as a state of complete loss of arousal to any kind of stimulation and complete loss of awareness of the self and the surrounding. One of the greatest challenges a pediatrician faces is the successful management of comatosed children. Coma is one of the important pediatrics emergency.[1,2] The epidemiology of coma varies considerably with age. For instance, in the study carried out at UK by Bowker et al., the age specific incidence of coma is greatest in children under 1 year of age (160 per 100,000 children per year), whereas the incidence of coma in children from non- traumatic causes is about 30 cases per 100,000 children per year (or 6 per 100,000) general populations per year.[2]

Department of Pediatrics, Women Medical College, Abbottabad.

Correspondence: Dr. Anila Farhat, Assistant Professor of Paediatrics, Women Medical College, Abbottabad
Contact No: 0321-9809131
Email: : paeds_doctor@yahoo.com

Received: August 10, 2017; Accepted: September 25, 2017

The cause of coma if not diagnosed timely by proper investigations, and managed accordingly, can lead to devastating consequences for child in terms of morbidity and mortality.[2]

Causes of non-traumatic coma range from common treatable to rare ones.[2] The most common cause of coma in children is intracranial infections, which include bacterial meningitis, viral encephalitis and tuberculous meningitis, followed by drug intoxication, seizures and inherited metabolic diseases.[3] Since infections of CNS are frequently encountered, high degree of suspicion is required for diagnosis.[4] CNS infections are classified on basis of etiology in to bacterial, viral, fungal and parasitic.[5,6] CNS infections cause acute encephalopathy in 65% of children presented with non-traumatic coma.[7,8] According to the study in Pakistan, 65% of the comatosed children had CNS infection in which 31% had bacterial meningitis, 18% had viral encephalitis and 12% had tuberculous meningitis[9] whereas the study in India showed 60% of the comatosed children had CNS infection in which 21% had viral encephalitis, 18% bacterial meningitis, 19% had tuberculous meningitis.[1] The importance of infective etiologies in children is in sharp contrast to adult hospital based studies where degenerative and cerebrovascular pathologies predominate. Among the

non-infectious causes, toxic-metabolic causes are the commonest.[2]

Tuberculous meningitis has 3 stages. In stage III (advance) there is severe clouding of sensorium, convulsion and coma.[10] About 97% of the patients with tuberculous meningitis present in stage II and III (coma).[11] Patients with bacterial meningitis can present with high pitch cry, irritability, vomiting, altered mental state and coma.[12] In viral encephalitis there is acute onset of neurological dysfunction that can lead to sudden deterioration of consciousness and coma.[8]

Better survival rate is observed in comatosed patients with CNS infection as compared to toxic-metabolic group so an early diagnosis of CNS infection in comatosed children is necessary by appropriate investigations.[1]

Our aim behind this study was to know relative frequencies of intracranial infections in comatosed children which will in turn be helpful in the early diagnosis and management of treatable causes of coma in our setup.

MATERIALS AND METHODS

This cross sectional study was conducted in the Department of Pediatrics, Benazir Bhutoo Shaheed Hospital Abbottabad with approval from hospital ethical committee. Full informed consent was taken from parents or attendants of the patients. Confidentiality of the data was ensured.

Inclusion criteria: This study was carried on 92 paediatric patients presented with coma with GCS <12 for more than 6 hours due to intracranial infections like tuberculous meningitis (TBM), bacterial meningitis and viral encephalitis (VE) diagnosed on the basis of history, clinical examination and relevant laboratory investigations such as lumbar puncture, CT scan and metabolic work up determined by clinical presentation. CSF cytology, biochemistry and culture were sent to hospital laboratory and reported by microbiologist and all tests were carried out in the same hospital laboratory.

Exclusion criteria: coma due to trauma, toxic-metabolic causes, post-status epilepticus, intracranial bleeding, hypertensive encephalopathy.

Details of history, examination findings and clinical variables like temperature, BCG scar, fits, acute onset of illness, neck stiffness, papilledema, corneal and pupillary reflex were recorded on structured proforma. Data was analyzed by using SPSS 17. Age, a quantitative variable, was described in terms of mean ± standard deviation. In the case of categorical variables like: gender, BCG scar, onset of illness, neck stiffness, seizures, pupillary and corneal reflexes, papilledema, GCS, and temperature; intracranial infection and its type, frequencies and percentages were calculated.

Diagnosis of bacterial meningitis was made when there was history of fever, fits, CSF culture for identification of microorganisms and/or CSF analysis showing Leucocytes > 100/mm^3 with neutrophil predominance, protein > 40 /mg, glucose < 40 mg/dl.[1]

TBM was diagnosed when there was positive family history of tuberculosis, positive mountoux test, CSF analysis showing Leukocyte count of (10 □ 500)/mm^3 with lymphocytes predominance, protein > 100 mg/dl, glucose < 40 mg/dl.[8] and/or CT/MRI showing basilar enhancement or communicating hydrocephalus with signs of cerebral edema or early tuberculoma.[20]

Diagnosis of Encephalitis was made when there was history of fever, headache and an altered mental state together with seizures and focal neurological findings with CSF analysis showing Leucocytes > 5/mm^3 with lymphocytes predominant, protein <40mg/dl, glucose < 80 mg/dl or on CT/MRI scans suggested HSV encephalitis.[1,20]

RESULTS

A total of 92 comatosed patients, who fulfilled the inclusion criteria over the study period, with evidence of intracranial infections and GCS<12 for more than 6 hours were included in the study.

Table No.1: Descriptive of comatosed patients by Gender

Gender	No. of patients		Age (Months)	
	Frequency	%age	Mean	Std. Dev.
F	29	31.5	40.69	31.738
M	63	68.5	47.91	44.959
Total	92	1100.0	45.64	41.212

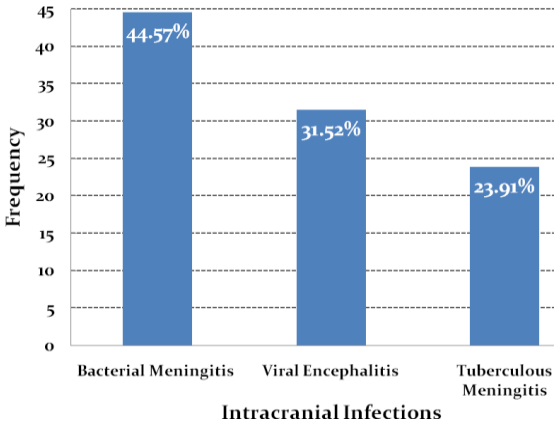

Figure 1 : Frequency of Intracranial Infections

Table 1 shows that among the total study population, male patients predominate with a total of 63 (68.5%) while 29(31.5%) were female giving male to female ratio 2.18:1. Gender wise, there was a significant difference amongst the patients. Mean age of the our patient was 45.64 ± 41.2 months with male patients having mean age of 47.91 ± 44.96 months and female patients with a mean age of 40.69 ± 31.74 months. Age wise, there was no significant difference amongst the patients.

As shown in Figure 1, the most common intracranial infection observed in comatosed patients in this study was bacterial meningitis with the frequency of 41 (44.6%) patients, followed by viral encephalitis with the frequency of 29 (31.5%) patients and tuberculous meningitis with the frequency 22 (23.9%) patients.

Among clinical variables observed in present study as tabulated in Table 2, temperature of more than 100 °F was present in 81(88%) of patient, BCG scar was present in 54 (58.7%) patients while 28 (30.4%) patients had acute onset of illness(with in 48hrs of onset of coma). Neck stiffness was observed in 63 (68.5%) patients. Fits were observed in 67 (72.8%) patients. Papilledema was detected in 34 (37%) patients. Pupillary and corneal reflex were absent in 17 (18.5%) and 19 (20.7%) of the patients respectively.

Table No.2**: Frequency of clinical variables in comatosed patients**

Variables	Frequency	Percentage(%)
Temperature (°F) > 100°F		
Absent	11	12.0
Present	81	88.0
BCG scar		
Absent	54	58.7
Present	38	41.3
Acute onset of illness		
Absent	64	69.6
Present	28	30.4
Neck stiffness		
Absent	29	31.5
Present	63	68.5
Fits		
Absent	24	26.1
Present	67	72.8
Papilledema		
Absent	58	63.0
Present	34	37.0
Pupil reactive		
Absent	17	18.5
Present	75	81.5
Corneal reflex		
Absent	19	20.7
Present	73	79.3

DISCUSSION

Coma is important clinical problem in pediatric practice. In many cases it results from primary insult to brain which if not treated timely can lead to permanent brain damage.

There are various causes of coma. Coma can result from trauma or wide variety of non-traumatic causes. Pediatric non-traumatic coma is a common presentation accounting for an estimated 10-15% of all hospital admissions. [9] Etiology of non traumatic coma is diverse ranging from common intracranial infections to rare ones however considerable regional diversity exits in these etiological factors with infectious problems suggested to be more common in developing countries. The data from developing countries is also limited where 80% of world's children live.[12] So the objective of conducting this study was to find out frequencies of common treatable intracranial infections leading to coma.

If we compare etiology of coma in children with adults we find that CNS infections are common cause of coma in children while degenerative and cerebrovascular pathologies predominate in adults.[2] Importance of infections as an aetiology of non–traumatic coma identified in this study is also supported by studies conducted in Pakistan, India, Saudi Arabia, Nigeria, England, Iran and Egypt.[1,9,13,14,15,16,17] Type of infection and their frequency seems to vary in different regions. For instance, cerebral malaria is important cause of coma in Africa and Dengue haemorrhagic fever in South East Asia.[1,18] While study conducted in Pakistan and in neighboring countries like Iran, India, Sri Lanka and Kashmir showed tuberculous meningitis, bacterial meningitis and viral encephalitis as important cause of coma in children.[1,9,17,19,20,21]

Amongst the three common causes of intracranial infections i.e. bacterial meningitis, viral encephalitis and tuberculous meningitis which were observed in present study, frequency of bacterial meningitis was highest i.e. 44%, which is consistent with the studies by Wong et al.[16], Suganthi et al.[19] Khodapanahandeh et al.[17] and Ahmed et al.[9] i.e., 47%, 42%, 36% and 31% respectively. In the present study, second most common intracranial infection was viral encephalitis in 31% of the cases; similar results were observed by Bansal et al.[1], Ahmed et al.[9], Ali et al.[14] in 30%, 18%, 17% cases respectively. In this study, tuberculous meningitis was the least common (23%), which was also observed in local study by Ahmed et al.[9], Iranian study by Khodapanahandeh et al.[17] and Kashmiri study by Ahmad et al.[20] who had 12%, 19% and 25% patients of TBM respectively. However, contradicting result was observed by Bansal et al.[1], who found tuberculous meningitis (31.6%) to be the most common CNS infection in comatosed children.

Intracranial infections are more common in the preschool age group of children having mean age of 45.64 months with predominance in male population i.e 68.5% as against 31.5% in female patients. This is in agreement with the studies of Ali et al.[14] Ibekwe et al.[15] and Ahmed et al.

Most common clinical sign observed in this study was temperature more than 100°F in 88% cases of the study population. Wong et al.[16] observed this in 55% and Ibekwe et al.[15] in 38% of cases. Wong et al.[16] and Khodapanahandeh et al.[17] observed fits as second most clinical sign in comatosed children which was also

observed in our study, i.e. 72% of the patients had fits. Fouad et al.[13] also observed fits in 65% of patients.

68.5% of our study population presented with neck stiffness while in study conducted by Bansal et al. only 29% of patients had neck stiffness. Acute onset of illness in this study was present in 28(30.4%) patients, while Ibekwe et al.[15] and Ahmed et al.[9] reported 23% and 40% patients had acute onset of illness respectively.

Papilledema indicates raised intracranial pressure and is associated with poor outcome. It was found in 40% of the cases by Bansal et al.[1] and similar result was found in this study i.e. 37%. While 18% of cases in local study by Ahmed et al.[9] had papilledema.

Pupillary reflex is good predictor of outcome; non-reactive pupil is strong predictors of fatal outcome. Bansal et al.[1], Fouad et al.[13] and Ahmed et al.[9] found 25%, 21% and 18% patients with non-reactive pupils respectively while in our study, 18.5% of the cases had non-reactive pupils.

Corneal reflex, on the other hand, shows functional interconnection in pons. In the study conducted by Bansal et al.,[1] corneal reflex was absent in 10% of the cases while in this study, 20.7% of the patients had absent corneal reflex.

CONCLUSION

It is concluded from present study that bacterial meningitis is the most common cause of non-traumatic coma in the study population followed by viral encephalitis and tuberculous meningitis. It is also concluded that intracranial infections are most common in preschool age group with male gender predominance. High grade fever is the most common clinical variable followed by fits and neck stiffness in comatose patients with underlying intracranial infections.

Author's Contribution:

Concept & Design of Study:	Anila Farhat
Drafting:	Sohail Babar
Data Analysis:	Sohail Babar, Anila Farhat
Revisiting Critically:	Sohail Babar, Anila Farhat
Final Approval of version:	Anila Farhat

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Bansal A, Singhi SC, Singhi PD, Khandelwal N, Ramesh S. Non Traumatic Coma. Ind J Pediatr 2005;72:467-73.
2. Bowker R, Stepheson T. The management of children presenting with decreased conscious level. Curr Pediatr 2006;16:328-35.
3. Bowker R, Green A, Bonham JR. Guidelines for the investigation and management of a reduced level of consciousness in children: implications for clinical biochemistry laboratories. Ann Clin Biochem 2007;44:506-11.
4. Foerster BR, Thurnher MM, Malani NP, Petrou M, Carets-Zumelzv F, Surdgsen PC. Intracranial infections: Clinical and Imaging characteristics. Acta Radiol 2007;48:875-93.
5. Rincon F, Badjatia N. Central nervous system infections in neurointensive care unit. Curr Treat Options Neural 2006;8:135-44.
6. Arif M, Jamali R, Wahid I, Khan A, Jamali D. Spectrum of neurological illnesses in pediatric ward of Northwest General Hospital, Peshawar. Kjms MAY-August 2016; 9(2): 268-71.
7. Davies E, Connolly DJ, Mordekar SR. Encephalopathy in children: an approach to assessment and management. Arch Dis Child 2012; 97: 452-58.
8. Clarke M, Newton RW, Klapper PE, Sutcliffe H, Laing I, Wallace G. Childhood encephalopathy: viruses, immune response and out come. Dev Med Child Neurol 2006;48:294-300.
9. Ahmed S, Ejaz K, Shamim MS, Salim MA, Khan MUR. Non-traumatic coma in pediatric patients: etiology and predictors of outcome. J Pak Med Assoc 2011;61:671-5.
10. Karande S, Gupta, Kulkarni M, Joshi A. Prognostic clinical variables in childhood tuberculous meningitis: An experience from Mumbai India. Neurol Ind 2005;53:191-5.
11. Van Well T JG, Paes BF, Terwer B, Springer P, Roord JJ, Donald PR, et al. Twenty years of pediatric TBM A Retrospective cohort study in Western Cape of South Africa. Pediatr 2009; 123:e1-e8.
12. Johnson ABR, Adedoyin OT, Abdul-Karim AA, Olanrewaju AI. Childhood pyogenic meningitis: Clinical & investigative indicators of etiology & outcome. J Natl Med Assoc 2007;8:937-47.
13. Fouad H, Haron M, Halawa EF, Nada M. Nontraumatic coma in a tertiary pediatric emergency department in Egypt: Etiology and outcome. J Child Neurol 2011;26:136-41.
14. Ali AM, Al-Abdulgader A, Kamal HM, Al-Wehedy A. Traumatic and non-traumatic coma in children in the referral hospital, Al-Hasa, Saudi Arabia. East Mediterr Health J. 2007;13:608-14.
15. Ibekwe RC, Ibekwe MU, Onwe OE, Nnebe-Agumadu UH, Ibe BC. Non-traumatic childhood coma in Ebonyi State University Teaching Hospital, Abakaliki, South Eastern Nigeria. Niger J Clin Pract 2011;14:43-6.

16. Wong CP, Forsyth RJ, Kelly TP, Eyre JA. Incidence, aetiology, and outcome of non-traumatic coma: a population based study. Arch Dis Child 2001;84:193-9.
17. Khodapanahandeh F, Najarkalayee NG. Etiology and Outcome of Non-traumatic Coma in Children Admitted to Pediatric Intensive Care Unit. Iranian J Pediatr 2009;19(4):393-8.
18. Gwer S, Chacha C, Newton CR, Idro R. Childhood acute non-traumatic coma: Aetiology and challenges in management in resource-poor countries of Africa and Asia. Pediatr Int Child Health 2013; 33(3): 129-138.
19. Suganthi V, Kumar MS, Kumar BRS. Non–Traumatic Coma In Children: Clinical Profile and Outcome. J Evol MedDent Sci 2016;5(17): 867-70.
20. Ahmad I, Ahmed K, Gatoo IA, Mir MY, Maqbool M, Baba AR. Non traumatic coma in children: A prospective observational study. Int J Contemp Pediatr 2015; 2(2): 77-84.
21. Kamra D, Rawat KA. Effect of stimulation in coma. Ind Pediatr 2006; 43: 856-60.