# Spectrum of Cranial Ultrasound in Neonatal Seizure- a Cross-sectional Study in a Tertiary Care Paediatric Hospital in Bangladesh

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**Abstract**

**Background:** Diseases of central nervous system of neonate commonly manifested by seizure, recurrence of which causes permanent damage of central nervous system, increase the risk of epilepsy and cognitive disabilities. Cranial Ultrasonography shows pathologic brain finding and prompt treatment will prevent further damage of immature brain. This study aims to assess cranial ultrasonography findings in neonatal seizure.

**Methods:** This hospital based prospective observational cross-sectional study has been conducted in the Department of Paediatrics, Dhaka Shishu Hospital from January to July 2020. Total 60 neonates presenting with seizure were enrolled in the study by random sampling. Baseline characteristics of convulsing neonates including sex, gestational age, weight, head circumference was recorded at admission. Clinical details of each seizure episode were reported by caregiver and attending doctor i.e., age at onset of seizure, duration of seizure, number and type of seizure. Ultrasonography of Brain was done every neonate having seizure. Informed written consent from caregiver was taken before enrolment.

**Results:** Among 60 neonates, Cranial ultrasound showed pathologic finding in 38(63.3%) cases. Hypoxic ischemic change was the commonest finding (68.4%), followed by raised parenchymal echotexture (23.7%), intracranial haemorrhage (2.6%), hydrocephalus (2.6%) and partial agenesis of corpus callosum (2.6%).

**Conclusion:** Hypoxic ischemic change was the commonest pathologic finding of cranial ultrasonography.

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## Introduction

Neonatal seizure manifests as stereotyped muscular activity or autonomic changes due to abnormal electrical discharge in the central nervous system of neonates.[1] First indication of neurological disorder may be seizure and the time of onset of seizure has relationship with the aetiology of seizure and prognosis.[2]

Perinatal asphyxia, metabolic abnormalities (hypoglycaemia, hypercalcemia, hypomagnesemia, hyponatremia and hypernatremia), infection (sepsis, meningitis and encephalitis),bleeding (subarachnoid, subdural, thrombosis and intraventricular haemorrhage), developmental anomalies (cerebral dysgenesis, incontinentia pigmenti) and other causes (drug withdrawal), hyperthermia, benign familial neonatal seizure, benign idiopathic neonatal seizures and benign sleep myoclonus are the major causes of neonatal seizures.[3-5]

Neuroimaging helps physicians to diagnose brain lesions, which in turn helps in clinical management and better outcome. Common modalities of neuroimaging done in neonatal period are cranial sonography, CT scan, MRI, EEG. Among them cranial sonography is cost effective, portable and radiation free. New-born's brain is suited for ultrasound image because many sutures and fontanels are still open and there can be used as acoustic window to look into brain.[6] Cranial ultrasound has become an essential diagnostic tool in depicting normal anatomy and pathological changes in neonatal brain.[7] It is essential to determine the etiology of seizure at the earliest because it gives an opportunity to treat the

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seizure actively and promptly an avoid preventable morbidity, mortality and sequelae associated with it.

Aims of the study were to describe clinical presentation, time of onset of seizure and to determine cranial ultrasonography findings in neonatal seizure.

## Materials and Methods

This was a prospective observational cross- sectional study, conducted in Department of Paediatrics at Dhaka Shishu Hospital, Sher-e-Bangla Nagar, Dhaka-1207, from January to July 2020.All the neonates (0-28 days) admitted in Department of Paediatrics with the history of convulsion or who developed convulsion during the period of his hospital stay were enrolled in this study. Detailed and distinct description of seizure given by caregiver or attending doctor were included and neonate having congenital malformation of brain, syndromic baby, caregiver not giving consent were excluded from this study. Informed written consent was taken from the caregiver. Data was collected by pretested structured questionnaire with proper permission.

Baseline characteristics of patient, clinical details of seizure- age of onset of seizure, duration, frequency, type of seizure were recorded. Cranial Ultrasonography was done from anterior fontanelle by a single radiologist with same ultrasonography machine. Data was described as mean± SD and percentage. After collection data editing and clearing was done manually, data processing and analysis was done by using SPSS (statistical package for social sciences) version-23.

## Result

A total number of 60 neonates having seizure were enrolled in this study. Out of 60 neonates, 41 (68.3%) were male and 19 (31.7%) females; male to female ratio of 2.16:1. Forty-four neonates were full term (90%), 6 were preterm (10%). Fifty-two cases (86.7%) were appropriate for gestational age (AGA) and 8 (13.3%) were small for gestational age (SGA). (Table-1)

**Table-1: Distribution of presenting characteristics of the enrolled neonates (n=60)**

| Characteristics | | Number | Percentage |
|---|---|---|---|
| Sex | Male | 41 | 68.3 |
| | Female | 19 | 31.7 |
| Gestational age | Term | 54 | 90.0 |
| | Preterm | 6 | 10.0 |
| Weight for gestational age | AGA | 52 | 86.7 |
| | SGA | 8 | 13.3 |
| Head circumference(Centimeter) | Mean±SD | 35.05±0.74 | |

In present study 22 (36.7%) neonates had seizure on 1st day,23 (38.3%) on 2nd day, 6 (10%) on day 3; that is 51 (85%) neonates had seizure within 72 hours. Within 72 hours perinatal asphyxia (68.6%) was the most common cause of seizure and after 72 hours of life, 9 (15%) neonates had seizure and meningitis was the predominant cause. (Figure-1)

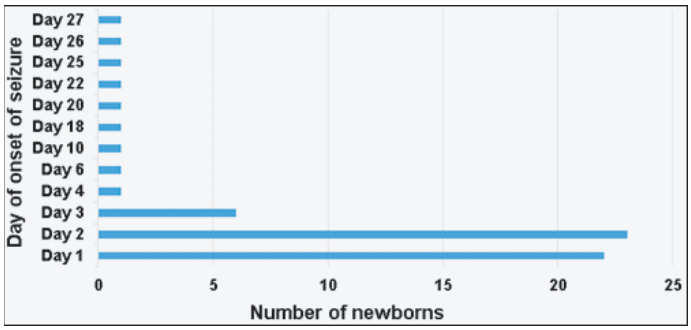


**Figure-1: Age of onset of seizure**

Generalized tonic seizure was the commonest type of seizure 43 (71.7%). followed by focal 10 (16.7%), subtle 5 (8.3%), myoclonic 1(1.7%) and partial 1(1.7%) seizure. (Table-2)

**Table-2: Distribution of Seizure characteristics (n=60)**

| Seizure type | Number | Percentage |
|---|---|---|
| Generalized tonic | 43 | 71.7 |
| Focal | 10 | 16.7 |
| Subtle | 5 | 8.3 |
| Myoclonic | 1 | 1.7 |
| Partial | 1 | 1.7 |
| **Total** | **60** | **100** |

Among 60 neonates, cranial ultrasonography showed pathologic finding in 38 cases (63.33%). Hypoxic ischemic changes 26 (68.4%) was commonest finding, followed by raised parenchymal echotexture 9 (23.7%), intracranial haemorrhage 1 (2.6%), hydrocephalus 1 (2.6%), partial agenesis of corpus callosum 1 (2.6%) were remaining findings. Twenty-two cases (36.7%) showed no change in ultrasonography. (Table-3)

**Table-3: Cranial USG finding of total studied neonates**

| Variables | Number | Percentage |
|---|---|---|
| No change | 22 | 36.7 |
| Pathologic change | 38 | 63.3 |
| HIE | 26 | 68.4 |
| Raised parenchymal echo texture | 9 | 23.7 |
| Hydrocephalus | 1 | 2.6 |
| Intracranial hemorrhage | 1 | 2.6 |
| Partial agenesis of corpus callosum | 1 | 2.6 |

## Discussion

Neonatal seizures have always been a topic of interest because of their universal occurrence. The presence of a seizure does not constitute a diagnosis, but it is a symptom of underlying CNS disorder due to systemic or biochemical disturbances.[8]

In the present study, out of 60 neonates 41 (68.3%) were male and 19 (31.7%) were female. Male to female ratio was 2.16:1, which is similar to the study conducted by Arunkumar et al (1.39:1). Mishra s et al also showed male predominance (1.8:1).[9,10] Male predominance may be due to health care seeking behaviour for male babies in our society.

In our study 52 (86.7%) neonate having seizure were appropriate for gestational age and 8 (13.33%) constituted low birth weight, which is similar to the study done by Das D et al showed AGA (81.7%), SGA (9.6%).[2] More number of neonatal seizures in neonates having birth weight 2500gm may be due to perinatal asphyxia is more common in these neonates. In this study term babies were 54 (90%) while preterm babies were 6(10%). The majorities of neonates who developed seizure were full term (90%) which is similar to the findings of Das D et al (91.3%) and Marjoki JMA et al (95.4%).[2,11]

In our study 85% neonates had seizure within first 72 hours of life which is similar to the study conducted by Das D et al (71.3%), Aziz A et al (83%).[2,12] But in a study conducted by Marzoki JMA et al most of seizure occur after 72 hours.[11] This difference may be due to etiology, in our study perinatal asphyxia was the main cause of seizure but in the study of Marzoki JMA et al metabolic abnormalities 42/88 (47.7%) was the most common cause of seizure.

Generalized tonic seizure 43 (71.7%) was predominant seizure in present study, most commonly associated with perinatal asphyxia, followed by focal (16.7%), subtle (8.3%), myoclonic (1.7%) and partial (1.7%). In a study conducted by Das D et al showed subtle seizure (49%), Aziz A et al showed focal clonic seizure (30%) as the commonest seizure type.[2,12]

In present study, cranial Ultrasonography showed pathologic finding in 38 (63.3%) cases, among them HIE changes 26 (68.4%) was the commonest finding followed by raised parenchymal echo texture 9 (23.7%), ICH 1(2.6%), hydrocephalus 1(2.6%), and partial agenesis of corpus callosum 1 (2.6%).

In a study by Nabavi S et al, 22% of hospitalized new-born showed pathologic finding in cranial USG, among them haemorrhage 12 (54.5%), hydrocephalus 7 (31.8%) and others 3 (13.6%).[13] In a study Zahid et al 48.5% of neonates with seizure showed pathologic findings such as ICH (27.6%), brain edema (11.7%), subdural hemorrhage (6.4%), and subarachnoid hemorrhage (5.3%).[14]

In the present study 63.3% cases showed pathologic finding in cranial USG, which is higher than the study conducted by Nabavi S et al (22%) and Zahid et al (48.5%).[13,14] Present study showed HIE (68.4%) was commonest among cranial USG findings in contrary to ICH in the studies conducted by Navabi S et al (54.5%), and Zahid et al (27.6%).[13,14]

## Conclusion

Cranial ultra-sonogram showed pathological changes in 63.3% cases, among them HIE changes (68.4%) was the commonest finding. Perinatal asphyxia (60%) was the most common cause of neonatal seizure.

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