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Seizure Pattern and Biochemical Abnormality in Neonatal Seizure

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Neonatal seizures have always been a topic of particular interest for the pediatricians. This is a more so because of its universal occurrence and varied number of conditions capable of causing it. Neonatal seizures are common neurological problem in neonatal period with a frequency of 1.5 to 14/1000 [1]. They are most common causes of referral to Pediatric neurology The presence of seizure does not constitute a diagnosis but it is a symptom of and underlying central nervous system disorder of systemic and biochemical abnormality, The neonate is at particular risk for development of seizure because of metabolic, anoxic, structural and infectious causes, although no cause can be identified in one fourth of cases [2]. It is essential to determine the etiology of seizure at the earliest because it gives an opportunity to treat the seizure actively and promptly to avoid unnecessary morbidity, mortality and sequelae associated with it [1]. The most hazardous period of life, unquestionably is the neonatal period, never again in life individual is confronted with more dramatic challenges than in transition from dependent intrauterine existence to independent post natal life, Because of immature nervous system of new born, newborn brain responds in form of convulsion even to minor insult. Seizure in new born is an acute emergency and frequently indicate significant damage to central nervous system in neonates. Clinical presentation of seizure, etiology and management and prognosis of seizure differ markedly to convulsions occurring in older children [3].

Seizure is defined as a paroxysmal involuntary disturbance of brain function. It may manifest as an impairment or loss of consciousness, abnormal motor activity, behavioral abnormality, sensory disturbance or autonomic dysfunction [4].

Seizure types in newborn differ considerably from those observed in older infants and the types in premature infant differ from those in full term infant. Unlike older infants, newborn infant rarely have well organized generalized tonic, clonic seizure.

Premature infant have less well organized spell than in full term babies [5]. The precise reason must relate to developmental state of nervous system in prenatal period. The most common neuroanatomical process occurring in this period is organizational event. These events are characterized by attainment of proper orientation, alignment and lying of cortical neurons. The elaboration of axonal and dendrics ramification and establishment of synaptic connections. This

process must be highly significant in providing cortical organization to propagate and sustain a generalized seizure. Such a degree of cortical organization is apparently not present in human neonates[6]. The paroxysmal discharge of neurons may occur at any level and may give rise to a corresponding change in clinical behavior.

Anybody who had seen a fetus at six to eight week gestation must have struck by the similarity of sudden mass flexor spasm (which is spinal origin) to the infantile type of lightning seizure spasm. Similar kinds of seizure may occur in full term anencephalic fetuses [7]. Rigidity of a limb or generalized muscular rigidity may occur due to a spinal lesion or peripheral nerve hyperactivity [8-9]. The brain stem in human infant is involved in many rhythmic activities such as sucking, respiration, cycling and walking movement. These may suddenly appear as ictus. Changes in respiratory pattern ,sudden assumption of a fixed posture or sudden bout of rapid sucking, blinking or cyclic movement may all indicate brain damage in neonate and to be equivocal of a convulsion[7].

Subtle seizure are most frequent seizure type, since its clinical manifestations are readily overlooked such manifestations may consist of only tonic horizontal deviation and or jerking of the eyes, repetitive blinking or fluttering eyelids, drooling, sucking or other oro -buccal movements, tonic posturing of limb or apnea, rowing, swimming and peddling movem-ents. Subtle seizures are most common in premature infants[6]. Other seizure types are focal-clonic and multifocal-clonic. In focal clonic type, seizures are well localized and in multifocal clonic, clonic movements migrate to another body part in a non ordeal fashion. Tonic seizures when generalized may appear like decerebrate posturing of older children but accompanying stertorus breathing, eye signs or occasional clonic movements that stamp these as convulsions. Myoclonic seizures are usually synchronous, these seizure take the form of single or multiple jerks of flexion of upper and/or lower limbs. Myoclonic seizures are divided into focal, multifocal and generalized myoclonic types. Multifocal refer to clinical activity that involve more than one site, whereas generalized refer to clinical activity that is diffusely bilateral, synchronous and non migratory.

The incidence of neonatal seizures has been put differently by different workers from 1.5/1000 to 14/1000 live births [1]. The highest incidence of neonatal seizure occurs during the first 48 hrs of life [3].

The international classification of epileptic seizures does not apply to newborn seizure [13] because neonates are unable to sustain organized discharge and do not manifest generalized tonic clonic seizures. Any abnormal, repetitive and stereotypic behavior in neonates should be evaluated as possible seizure [14]. Volpe[15] in 1989 very simple and effective classification i.e., he sub classified seizures into four types: Subtle clonic, tonic, myoclonic.

Hill and Volpe[16] in the year 1994 classified neonatal seizures into following types: 1. Subtle 2. Tonic (generalized, focal), 3. Clonic (multifocal , focal) 4. Myoclonic (Focal, multifocal, generalized). This classification is in use recently. The etiology of neonatal seizures is not disease specific, and the sick neonate may present with seizures due to a combination of abnormalities [17]. Although asphyxia is a cause of neonatal seizure include hypoxic-ischemic-encephalopathy. (commonest cause), intra-cranial hemorrhage hypoglycemia, hypocalcaemia, , intracranial infections, development defects and drugs withdrawal [18].

In a neonate presenting with seizures blood should be obtained for glucose, calcium, and magnesium and electrolyte estimation. A lumber puncture is indicated in virtually all neonates, unless cause is obviously related to a metabolic disease such as hypoglycemia, hypocalcaemia secondary to high concentration of phosphates. Cerebrospinal fluid findings may indicate a bacterial meningitis or aseptic encephalitis. A blood in Cerebrospinal fluid indicates a traumatic tap or subarachnoid hemorrhage. Blood culture Sensitivity should be done to rule out septicemia[1] ultrasonography and computerized tomography scanning have got important role to establish the etiology of seizures in neonates.

The present study is being undertaken at I.G.M.C Shimla with following aims and objectives.

1. To find out the incidence of neonatal seizures amongst hospitalized neonates.
2. To study the clinical profile of neonatal seizures.
3. To study the etiological profile of neonatal seizures.
4. To study the biochemical parameters in neonates presenting with seizures.
5. To study the ultrasonography skull finding in neonates

Material and Method

Present study was conducted in the department of pediatrics, Indira Gandhi Medical College, and its neonatology unit at Kamla Nehru Hospital, Shimla for a year. All children between the age group of first day life to 28 days, who were brought with history of seizures or those who were, otherwise, hospitalized but developed convulsions during their stay in the hospital were included in study. Besides these neonates, all cases referred to us from various peripheral health institutions in the state because of seizure were also included in the study. A detailed history was recorded in each case on a pretested Performa. Emphasis was laid on the age of occurrence of first seizure, duration of seizure, number of seizure type of seizure, antenatal, natal and post natal risk factors which includes drug addiction/withdrawal, maternal diabetes, prolonged rupture of membrane, asphyxia, traumatic delivery, preterm, small for date, low birth weight baby, meningitis, intracranial bleed and hyperbilirubinemia. The Dubowitz et al[100] parameters were used to estimate and confirm the gestational age. Thorough systemic examination was done.

Following definitions, terms and diagnostic criteria were used according to specifications given in standard text books. Seizure is defined as paroxysmal involuntary disturbance of brain function that may manifest as an impairment or loss of consciousness, abnormal motor activity, behavioral abnormality, sensory disturbance or autonomic dysfunction [4].

Neonatal Seizures

Seizures occurring during first 4 weeks of life were classified as neonatal seizures. these were classified according to classification given by Hill and Volpe in 1994 [16].

Biochemical abnormalities

The criteria for diagnosing various biochemical disorders were as follows:- Hypocalcaemia Ca < 7.0 mg/dl , Hyperphosphatemia P > 8.0mg/dl , Hypomagnesaemia Mg< 1.5 mg/dl, Hypermagnesaemia Mg>2.5mg/dl, Hyponatraemia Na< 130 meg/1, Hypernatraemia Na> 150 meg/1,Hypokalemia K<3.5 meg/1, Hyperkalemia K> 5.5 meg/1,Serum zinc levels of less than 65 meg/dl were considered low. Serum zinc levels of more than 120 meg/dl were considered high. Hypoglycemia was diagnosed if blood glucose levels were less than 30 mg/dl in preterm infants and less 40 mg/dl in term neonate.

All the subjects were subjected to following investigations:

Hemoglobin estimation by Sahli's method. Total leukocyte count, using improved Neubauer's chamber. Differential leukocyte count was done after staining the smear with Giemsa's stain and viewing under oil immersion. Erythrocyte sedimentation rate was done by using Westergreen tube. Serum calcium estimation by Precipitation method[101]. Serum phosphors estimation by phosphomolybdate method [102]. Serum zinc and magnesium estimation by atomic absorption spectrophotometry [103]. Serum sodium and potassium estimation by flame photometry [104]. Blood glucose estimation by glucose oxidizes method [105]. Ultrasonography The procedure was performed through the open anterior fontanelle using RT -3000 Machine. Following investigations were done as and when required.1) Cerebro spinal fluid examination: Cytology Biochemistry Culture gram staining 2) Blood culture sensitivity 3) X ray skull 4) EEG 5) CT scan was done using CT Sytec SRI (WIPRO GE)

Observations

Table 1-Showing incidence of seizure in neonates

	Total Number Of Subjects	Number With Neonatal Seizures	Percentage
Inborn	2427 (88.32%)	32	1.31
Outborn	321(11.68%)	27	8.41
Total	2748(100%)	59	2.14

P<0.001

Overall incidence of Neonatal seizure was 2.14%. The incidence of seizures were (8.41%) in neonates who were delivered outside the institution and incidence was (1.31%) in inborn neonates.

Table 2: Incidence in relation to gestation age

Gestational age	Total number of Patients	Number of Cases	Percentage -
>37 Weeks	2363	42	1.77
< 37 Weeks	385	17	4.41
Total	2748	59	2.14

P<0.001

Neonatal seizure were seen more commonly in Preterm (4.41 %) as compared to term babies(1.77%) .

Table 3 incidence of seizure according to age and sex

Age	No of Patients		Total (No=59)
	Male(No=38)	Female(No=21)	
≤ 7	27 (45.76%)	14 (23.73%)	41(69.49%)
7- ≤14	4 (6.78%)	3 (5.08%)	7(11.86%)
14- ≤ 21	1 (1.70%)	2 (3.39%)	3 (5.09%)
21- ≤ 28	6(10.17%)	2 (3.39%)	8(13.56%)

Neonatal seizure were more common upto first 7 days of life (69.49%) . Incidence decreases in the 2nd (11.86%) and 3rd (5.09%) week and to rise again in the 4th week to 13.56%. An overall male: female ratio of 1.80:1 was seen

Table 4 Distribution of neonates according to clinical type of seizure

Seizure Type	Number	Percentage
Single Type	41	69.49
Combined Type	18	30.51

More than 2/3 cases (69.49%) had single type of seizures.

Table 5: Distribution of cases with single type of seizures activity (No=41).

Single Type Of Seizures Activity	Number	Percentage
Subtle	16	39.02%
Focal Clonic	8	19.51%
Multifocal Clonic	7	17.07%
Focal Tonic	3	7.32%
Generalized Tonic	2	4.88%
Focal myoclonic	3	7.32%
Multifocal myoclonic	1	2.44%
Generalized myoclonic	1	2.44
Total	41	100%

Subtle seizures were the most common type of seizure activity seen in 16 (39.02%) of cases.

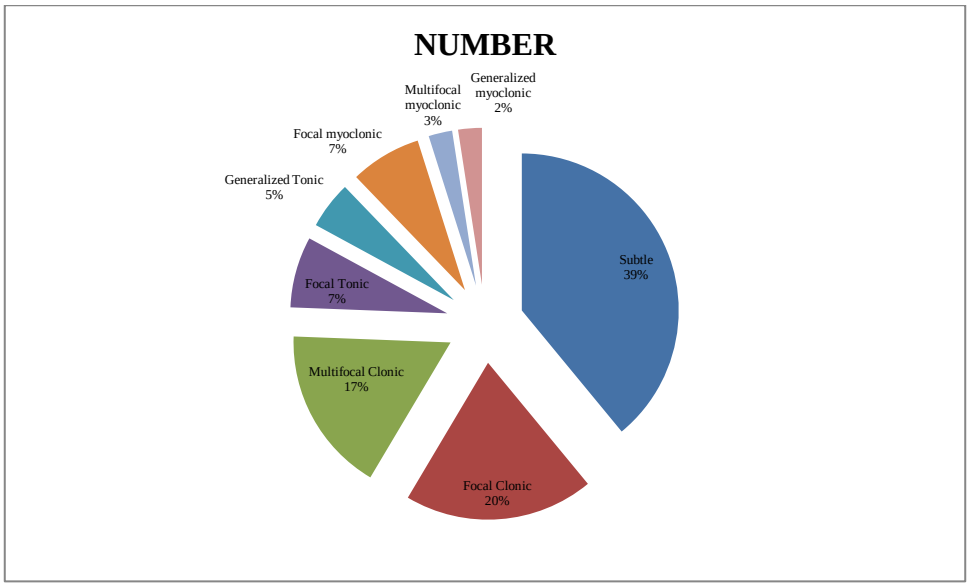

Table 6: Distribution of.cases with combined type of seizures activity (No =18).

Combined Type Of Seizures Activity	Number	Percentage
Subtle + Multifocal clonic	8	44.44%
Subtle + Focal clonic	4	22.22%
Subtle -f Focal Tonic	2	11.11%
Subtle + Generalized Tonic	3	16.67%
Subtle + Generalized myoclonic	1	5.56%
Total	18	100%

Subtle seizure were associated in all the cases with combined type of seizures of this group. Subtle with multifocal clonic variety was most common type of seizure activity seen in 8 (44.44%) of cases.

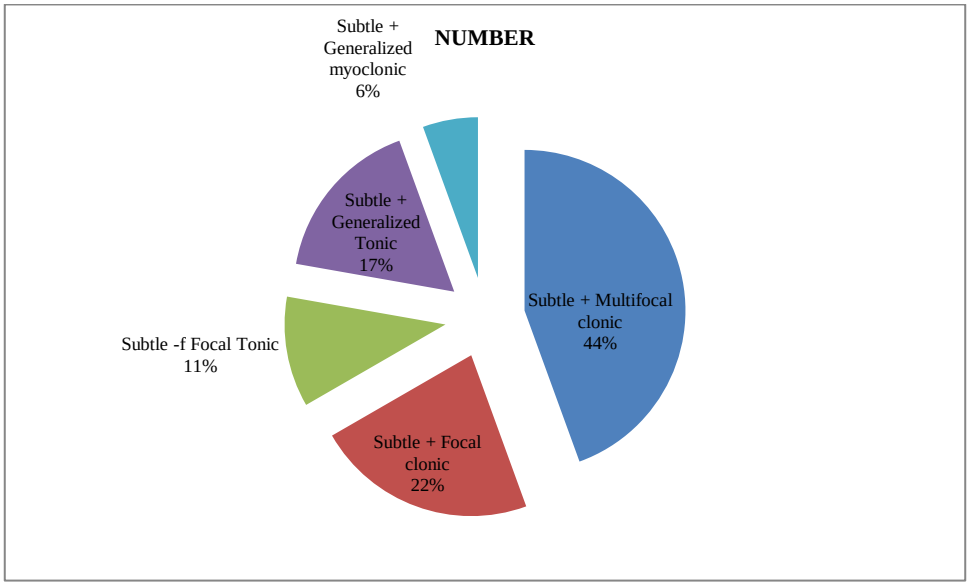

Table 7: Distribution of patients in relation to duration of seizure in neonates

Duration	No. Of Patients	Percentage
0-2 Minutes	39	66.10
3-5 Minutes	15	25.42
> 5 Minutes	5	8.47

39 neonates (66.10%) had seizures for less than 2 minutes, seizures lasting more than 5 minutes were seen in 5 (8.47%) patients and 3 of them had intracranial bleed as the etiological factors.

Table 8: Distribution in relation to antenatal and natal risk factors.

Risk Factors	No. Of Cases	Percentage
No risk factors	12	14.1
Prolonged rupture of membranae	9	10.59
PROM + High perinatal score	4	4.71
Diabetes mellitus	2	2.35
Perinatal asphyxia	21	24.71
Traumatic delivery	7	8.24
Low birth weight	6	7.06
Small for gestational age	6	7.06
Preterm	17	20.00
Antepartum hemonhage	1	1.17
Total	85	100

Multiple risk factors were present in 26 cases (30.59%), while no risk factor in 12 patients (14.11%).

Perinatal asphyxia was the commonest risk factor responsible for 21 (24.71%) cases followed by prematurity in 17 (20%).

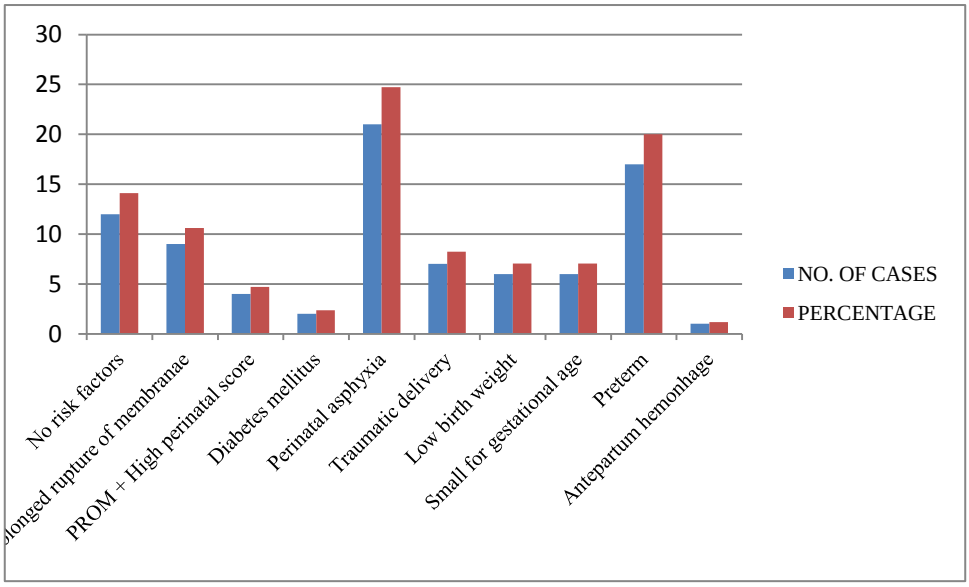

Table 9: Distribution of patients of neonatal seizures as per etiology and gestation

Etiology	Total Number Of Patients		
	Term	Preterm	Total
HIE	16 (38.09%)	7(41.17%)	23(38.99%)
Intracranial bleed	4 (9.52%)	3 (17.64%)	7 (11.87%)
Ac. Septic Meningitis	10 (23.80%)	2(11.76%)	12 (20.34%)
Metabolic	6 (14.28%)	4 (23.52%)	10 (16.95%)
Kernicterus	2 (4.76%)	—	2 (3.39%)
Cong. Hydrocephalus	1 (2.38%)	—	1 (1.69%)
Unknown	3(7.14%)	1 (5.88%)	4 (6.78%)
Total	42 (71.2%)	17 (28.8%)	59 (100%)

Hypoxic-Ischemic-encephalopathy (HIE) was commonest cause of neonatal seizure (38.98%). In 4 (6.77%) of cases etiology could not be ascertained. None had family history of neonatal convulsions.

Acute septic meningitis accounted for convulsions in 12 patients with suggestive Cerebro Spinal Fluid findings on cytology and biochemistry. However Cerebro Spinal Fluid culture was sterile in all the cases. Of these 12 cases blood culture was positive in 5 cases showing E coli. in two, Staphaylococcus in two and Klebsella in one of them. In addition 3 cases had bronchopneumonia and pyoderma in 2 cases.

Table l0 Distribution of cases in relation to etiology and seizure type

ETIOLOGY	TOTAL CASES	SUBTLE	FOCAL CLONIC	MULTI FOCAL CLONIC	GEN. TONIC	FOCAL TONIC	FOCAL MYO-CLONIC	MULTI FOCAL MYO CLONIC	GEN. MYO CLONIC
HIE	23 (38.99)	15 (65.21%)	2 (8.69%)	7(30.43%)	1 (4.34%)	1 (4.34%)	1(4.34%)	0	0
Intracranial bleed	7 (11.87%)	4 (57.14%)	1 (14.28%)	1 (14.28%)	2 (28.57%)	1 (14.28%)	0	1 (14.28%)	2 (28.57%)
Meningitis	12 (20.34%)	5 (41.66%)	6(50%)	2 (16.66%)	0	1 (8.33%)	2 16.67%)	0	0
Kernicterus	2 (3.38%)	0	0	1 (50%)	2 (100%)	1(50%)	0	0	0
Metabolic	10 (16.95%)	7 (70%)	1 (10%)	3 (30%)	0	0	0	0	0
Cong. Hydrocephalus	1 (1.69%)	1 (100%)	1(100%)	0	0	0	0	0	0
Unknown	4 (6.78%)	2 (50%)	1(25%)	1 (25%)	0	1(25%)	0	0	0
Total	59 (100%)	34(57.62%)	12 (20.33%)	15(25.42%)	5 (8.47%)	5 (8.47%)	3 (5.08%)	1(1.69%)	2 (3.38%)

Subtle seizures were the commonest manifestation of neonatal seizure (57.62%) i.e 34 out of 59 cases.

Table 11: Distribution of patients in relation of etiology and age of occurrence of seizures in neonates.

ETIOLOGY	Number	0-2 DAYS	3-4 DAYS	5-7 DAYS	> 7 DAYS
HIE	23 (38.99%)	19 (59.37%)	3 (42.85%)	1 (50%)	—
Intracranial bleed	7(11.87%)	3 (9.37%)	1 (14.28%)	___	3 (16.67%)
Meningitis	12 (20.34%)	2(6.25%)	1 (14.28%)	—	9 (50%)
Metabolic	10 (16.95%)	6 (18.75%)	1 (14.28%)	1 (50%)	2(11.11%)
Kernicterus	2(3.38%)	1 (3.12%)	—	—	1 (5.55%)
Cong. Hydrocephalus	1 (1.69%)	—	—	—	1 (5.55%)
Unknown	4 (6.78%)	1 (3.12%)	1 (14.28%)	—	2(11.11%)
Total	59 (100%)	32(54.23%)	7(11.86%)	2 (3.38%)	18(30.51%)

Neonatal seizures were observed most commonly during first two days of life (54.23%). Hypoxic-Ischemic-Encephalopathy was responsible for convulsion in the first week of life only more so in the first two days. Ac Septic meningitis accounted for half of the-cases beyond seven days of life.

Table 12: Showing serum values of calcium, glucose, magnesium, zinc, phosphate, sodium and potassium in neonates of metabolic seizures.

	NUMBER OF NEONATES									
	PRETERM				TERM					
	1	2	3	4	1	2	3	4	5	6
Calcium (mg%)	6.0	9.8	6.3	6.7	10.8	6.4	6.7	8.7	6.6	6.8
Glucose (mg%)	36	40	14	66	46	20	38	35	23	88
Phosphate	6.3	6	5.4	7.0	5.5	9.8	6.7	6.7	5.0	7.2
Magnesium	2.0	1.2	1.8	1.5	2.2	2.4	1.8	1.7	1.4	1.6
Zinc (meq/dl)	72	76.5	118.3	104.2	106	106.5	94.3	103.2	104	104
Sodium (meg/It)	138	132	146	140	134	137	144	135	142	137
Potassium (meg/It)	3.8	4.2	3.7	4.2	5.0	4.7	4.8	4.2	4.2	5.0

Calcium value ranges from 6.0 to 6.7 in preterm (mean 6.5 mg.%) and in term from 6.4 to 6.8 mg% (mean 6.62 mg%), only one preterm child showed hypoglycemia with blood sugar level of 14 mg% and in term babies blood sugar level ranges from 20 to 35 mg% (mean value 26 mg%). Magnesium value was normal except in one preterm (1.2 mg %) and in one term neonates (1.4 mg %). Serum zinc value ranges from 72 to 118.3 meg/dl (mean 92.7 meg/dl) in preterm and from 94.3 to 106.5 meg/dl (mean 103

meg/dl) in term babies. Serum sodium value ranges from132 to 146 meg/It (mean 139 meg/It) in preterm and from 134 to 137 meg /It (mean 138 meg/It). Serum potassium value ranges from 3.7 to 4.2 meg/It (mean 3.9 meg/It) and from 4.2 to 5.0 meg/It (mean 4.65 meg/It) in term babies.

Table 13: Distribution of patients of "non metabolic seizures" in accordance with biochemical profile .

Etiology & total no. of cases.	No.Showing metabolic abnormality	Hypocalcemia	Hypomagnesemia	Hypermengesemia.	Hyponatremia.	Hypoglycemia.
HIE (23)	11 (47.82%)	4 (17.39%)	2 (8.69%)	1 (4.3%)	2(8.69%)	5 (21.73%)
Intracranial bleed (7)	4 (57.14%)	2(28.57%)	~	—	1 (14.28%)	2(28.57%)
Meningitis (12)	4(33.33%)	2 (16.66%)	--	—	2(16.66%)	1 (8.33%)
Others (7)	-	-	-	-	-	-
Total (49)	19 (38.77%)	8 (16.32%)	2 (4.08%)	. 1 (2.04%)	5 (10.20%)	8 (16.32%)

Metabolic abnormality was present in 19 (38.77%) neonates in addition to known non metabolic causes, Associated metabolic abnormality was observed more often with Hypoxic-Ischemic-Encephalopathy (11 out of 19) cases and hypoglycemia was most common in this group. Serum zinc and potassium levels were found to be normal in all the cases. Others include cases of kericterus, cong. hydrocephalus and unknown.

Table 14: Distribution of patients according of neonatal seizures in relation to cranial ultrasonography findings (No. =47).

Ultrasonographic Findings	No. Of Cases	Percentage
Normal	35	74.46
Ventricular dilation	2	4.25
Intracranial bleed	5	10.63
Cerebral edema	4	8.51
Fracture skull with I.C. bleed	1	2.12%
Total	47	100

On ultrasonography abnormalities were detected in 12 cases (25.53%) and USG could not be done in 12 neonates (20.33%) having seizure.

Table 15: Distribution of patients according to CT. Skull findings (n=4).

CT SKULL FINDINGS	NO. OF CASES	PERCENTAGE
Normal	1	25
Cerebral edema	1	25
Intracranial bleed	1	25
Fracture skull with I.C bleed	1	25

Out of 59 cases only in 4 cases CT skull was done.

* 7 patients had intracranial bleed of which 4 (8.51 %) had intracerebral and 3 (6.38%) cases had intraventricular bleed.

Discussion

Convulsions during the first few weeks of life are a frequent clinical problem and often the presenting manifestations of serious neurological dysfunctions in the newborn. The identification of seizures present a significant clinical problem in caring for newborn. Seizures are the first sign of neurologic disease or dysfunction.. Their expression at this age is quite variable, poorly organized and often subtle. A knowledge of incidence, natural history and clinical profile and etiology is very essential for proper evaluation and management of patients. In the present study, the incidence of neonatal seizure among hospital born was found to be 1.31%, whereas among out born who were admitted to our

incidence was much higher 8.41% (P< 0.001), giving an overall incidence of 2.14%. Incidence was found to be much higher in preterm babies 4.41% as compared term babies 1.77% (P<0.001). In inborn babies, incidence was 3.12% and 1.01% in preterm and term babies respectively (P < 0.001) and in out born babies the incidence was 18% in preterm and 7.29% in term respectively (< 0.05). The incidence of neonatal as reported by various authors ranges from 0.15% to 1.4%

Table 16: Incidence of neonatal seizure as reported by various authors

S.No.	Incidence	Year	Percentage
1.	Burke [10]	1954	0.2
2.	Keen [11]	1969	0.9
3	Garg [3]	1972	0.2-0.8
4	Brown and Coworkers [40]	1972	1.4
5	Brown [7]	1973	1.2
6	Lee [41]	1973	1.2
7	Eriksson and Zetierstrom [39]	1977	0.15
8	Dennis J [38]	1978	0.4
9	Meffitus et al [106]	1982	0.6
10	Goldberg [43]	1983	0.6
11	Bergman et al [44]	1983	0.6
12	Singh M et al [107]	1990	0.7
13.	Airede [1]	1991	0.8
14.	Present Study	1997	1.3

Overall incidence of seizures in preterm neonates in present study is 4.41%,which is comparable to incidence reported by Airede (4.8%) in 1991 from Nigeria [1]. Higher incidence of neonatal seizures in the present study may be attributed to the fact that this is being the apex institution of state, and all high risk deliveries are conducted this hospital.

AGE

In the present study of 59 neonates, 41(69.49%) cases presented with seizures; first week of life and in 7 (11.86%) cases reported during second week. Rose A.L and Lombraso C.T. in 1969 [2] from Bostan, reported incidence of 115(76.66%) cases : first week, 21(14.09%) cases during 2nd week and 13(8.72%) after 2nd week oflife and Garg PK[3] from Wisconsin, reported the similar incidence of 115 (77.18%) ring 1st week and 34(22.82%) cases after 2nd week. In present study out of total cases, 32 (54.23%) cases had convulsions during first 2 days of life and H.I.E remains the main etiologic factor. Calciolari et al in [121 reported that out of 150 cases, 110 (73.3 %) had convulsions during 1st two days life and remain the H.I.E main etiological factor in 87(79.09%) of cases. Whereas kumar et al[20] from, Varanasi, reported 16 cases of birth asphyxia and all 16 (100%) had convulsion during first two days of life. In the present 18 (30.51%) cases had convulsions after seven days of life which were mainly due to central nervous system infections,

Sex

In present study an overall male to female ratio of 1.80:1 was seen. It is comparable to studied by Dennis J [38] and Airede [1] who had also reported male and female ratio of 1.30:1 and 2:1 respectively.

Clinical Profile

Table 17: Clinical profile of seizures in neonates as reported by various workers.

Seizure type	Calcialari Et Al [12] 1988	Airede[1] 1991	Present study 1997
Single type	50%	91%	69.49%
subtle	21%	16%	27.11%
Focal clonic	7%	23%	13.55%
Multifocal clonic	15%	---	11.86%
Generalized Tonic	5%	51%	3.39%
Myoclonic	2%	11%	8.47%
Combined Type	50%	9%	30.51%
Subtle+multifocal clonic	23%	---	13.55%
Subtle+Gen.tonic	7%	9%	30.51%
Subtle+Focal tonic	3%	---	6.77%
Subtle+Gen.tonic+Multi.clonic	11%	---	---
Other	5%	-----	5.08%

In the present study, out of 59 neonates 69.49% cases had single seizure type, Subtle seizure were most common in 27.11 % of cases, focal clonic in 13.55 %, multifocal 11.86%, Generalized tonic 3.39% and myoclonic in 8.47% of the cases. Combined type of seizure activity was observed in 30.51 % of cases, of these subtle and mutlifocal variety was observed in 13.55% of cases, subtle and generalized tonic 5.08%, Subtle and focal clonic in 6.77% of cases. Calciolari et al in 1987[12] from, Washington, reported single seizure type in 50% of cases and combined type in 50%.. Of single seizure type, subtle seizure were more common in 21% cases followed by multifocal clonic in 15%, 7% had focal and 2% had myoclonic seizure activity. Subtle and multifocal clonic variety were most common seizure activity seen in 23% of cases followed by subtle and generalised tonic and multfocal clonic in 11% of cases. Both studies are quite similar in that subtle seizure were commonest type of seizure in both single and combined type followed by subtle and multifocal clonic variety. Frequency of type of seizure activity was also similar. However. these findings are in contrast to observed by Airede [1] from Nigeria, who observed single type of seizure in 91 % cases and combined type in 9 %.

Etiology

Table Revealing etiological factors of neonatal seizures as reported by different workers.

S.No.	Etiological factors	ZETTERST Rom & ERIKSSON [39] 1997 (Sweden)	MIZRAHI [55] 1987 (Taxas)	CALCIOLARI [12] 1988 (Washington)	AIREDE [1] 1991 (Nigeria)	KUMAR ET AL [20] 1995 (Varanasi)	PRESENT STUDY 1997 (Shimla)
1	H.I.E.	37(48%)	38(46.3%)	97(66%)	27 (47.4%)	16 (45.7%)	23 (38.99%)
2	infection	9(12%)	14 (17.1%)	8(5%)	5 (8.8%)	6(17.1%)	12 (20.34%)
3	metabolic	9(12%)	7(8.6%)	8(5%)	23 (40.4%)	9 (25.7%)	10(16.95%)
4	unknown	26 (28%)	2 (2.4%)	8(5%)	—	2 (5.7%)	4 (6.78%)
5	Kernicterus	--	--	---	—	1 (2-9%)	2 (3.39%)
6	I. C bleed	---	13 (15.8%)	15 (10%)	4(7%)	1 (2-9%)	7(11.87%)
7	Dev. Defect.	—	3(3.71%)	9(6%)	-	—	1 (1.69%)
8	5 Th. day fit	-----	—	3 (2%)	—	—	—
9	familial	____	—	1 (1%)	—	—	—
10	infarction	------	5 (6.1%)	—	—	—	—
	Total	77 (100%)	82 (100%)	150 (100%)	57 (100%)	35 (100%)	59 (100%)

In the present study, H.I.E. was commonest cause of seizure observed in 23 (38.38%) cases followed by infections which are comparable observations made by kumar et al.[20] from Varanasi. Furthermore kumar et al less incidence (2.9%) of intracranial bleed in their series as compared to present study (11.87%). The difference may be due to the fact that in the present study we had done cranial ultra sonography in almost all neonates having seizures and C.T. as and when required at the earliest, so intracranial bleed was picked up in more of cases having neonatal seizures.

The present study is in conformity to the one conducted by Mizarhi et al [55] from Taxas.

In both studies incidence of Hypoxic-Ischemic-Encephalopathy, infections and Intracranial bleed leading to neonatal seizures is comparable. Incidence of metabolic seizure is much higher in the present study (18.9%) as compared to Mizrahi[55]. The difference could be due to the fact that metabolic group comprised of inborn error of metabolism and hypoglycaemia in a study conducted by Mizrahi whereas in the present study metabolic group included hypoglycaemia, hypocalcaemia, Hypomagnesaemia, hyponatremia and hypernateramia. So we have studied more metabolic factors as compaired to studied by, Mizrahi et al [55]

Bio Chemical Profile

In the present study, overall biochemical abnormalities were observed in 29 cases which constituted 49.15% of all the subjects .Of these 29 cases, hypocalcaemia was observed in 15 (51.72%) cases, hypoglycaemia in 12(41.37%), hypomagnesaemia in 4(13.79%) cases while hypermagnesaemia, hyperphosphatiemia and hyponatraemia were in 3.44%, 3.44% and 17.25% of the cases respectively. Kumar et al in 1995 [20] studied 35 neonates for biochemical abnormalities. In 22(62.8%) of their cases, hypocalcaemia was detected in 7 (31.8%), hypoglycaemia in 11{90%), hypomagnaesaemia in 3 (13.63%) cases while hypermagnaesaemia, hyperphosphatemia and hyponatraemia were present in 4.54%, 13.63% and 45.45% of cases respectively.

The present study and the study conducted by Kumar et al[20] showed one similarity that the biochemical abnormalities were seen in cases of H.I.E., I.C. bleed, infections and metabolic disorders. Hypocalcaemia and hypoglycaemia were the most common metabolic abnormalities detected by Kumar et al which is in concordance with the present study.

Kumar et al[20] observed 9 cases of primary metabolic disorder, 5 (55.55%) had hypocalcaemia, 2(22.22%) cases with hyperphosphatemia and 5 (55.55 %) cases with hypoglycaemia, Whereas in the present study 10 neonates with seizure's had primary abnormalties. Hypocalcaemia was observed in 7 (70%) of neonates while hypoglycemia as metabolic abnormalty was detected in 4(40%) of cases. In all these the common metabolic abnormalties were hypocalcaemia and hypoglycaemia..

Zinc estimation were done in 48 out of 59 neonates with seizures and zinc value found to be within normal range [72-118.3 meq/dl] in all the babies. Kumar et al J20] in the year 1995 studied 35 patients for acute zinc deficiency, zinc estimation was done in all of his subjects they too did not find any abnormal value of serum zinc.

Ultrasonagraphy

In the present study ultrasonagraphy was done in 47 cases out of which 35(74..46%) cases were found to be normal, 4(8.5%) cases had cerebral edema and in 7(14.89%) cases intra cranial bleed was detected. Out of 7 cases of intracranial bleed, 4(8.5%) cases had intracerebral bleed and 3 (6.38%) cases had intraventricular bleed. Mizrahi and Kellaway [55] from Taxas in 1987 studied 82 neonates, 60 cases (80.48%) showed normal study on ultrasonography whereas 6 cases (7.3%) had intracerebral bleed. 5 (6.1%) with intraventricular bleed which is comparable to the present study, where as Partridge et al in 1983 [95] observed in their study, normal ultrasonagrapic skull finding in 29 (45.3%) cases, intraventricular hemorrhage in 6 (9.4%) cases, intraparenchymal bleed in 5(7.8%), intraventricular and intraparenchymal bleed in 10 (15.6%) of cases and subependymal bleed in 13(20.3%) of cases. This difference is due to

inclusion of only preterm babies (gestational age 24-33 weeks) in their study.

Summary and Conclusions

The present study was conducted in the department of Pediatrics, Indira Gandhi Shimla. The study was carried to find out the incidence of etiology, and ultrasonographic findings in seizures in neonates.

In the present study, out of 2748 babies, 59 developed seizures giving an overall incidence of 2.14%.

Among hospital born neonates seizures were present in 1.3% neonates and in out born neonates who were referred to this institution, incidence was 8.41 %

Neonatal seizures were much more common in preterm neonates (4.41%) as compared to term neonates (1.77%). Neonatal seizures were present in (3.12%) of inborn and (18.18%) of out born preterm neonates and in (1.01%) and (7.29%) term neonates respectively.

Neonatal seizures were more common upto first 7 days of life (69.49%) and more so commonly during first 2 days of life (54.23%). The incidence is decreasing towards the end of first week.

Incidence of seizures were higher in males as compared to female 64.4% vs 35.6%.

Hypoxic-Ischemic-Encephalopathy was commonest etiology in term and preterm neonates, Intracranial bleed was more common in preterm and acute septic meningitis in term neonates. Metabolic seizures were present in (23.52%) in preterm and (14.28%) in term neonates. No diagnosis could be made in 4(6.78%) cases.

Single seizure type was present in 69.49% and combined type in 30.5% cases of neonates. Subtle seizures were the commonest single type of seizures seen 27.11% of cases while a combination of subtle and multifocal clonic accounted for 13.55% cases of combined type of seizures.

Subtle seizures were the commonest type of neonatal seizures in all etiological groups, except focal clonic in meningitis group. 9. 39 (66.10%) cases had seizures for less than 2 minutes only 8% cases have seizures for more than 5 minutes.

Antenatal and natal risk factors were seen in (82.35%) of cases, parinatal asphyxia and prematurity were the commonest risk factors under our set up.

Metabolic seizures accounted for 10(16.94%) cases of neonatal seizures. hypocalcaemia was commonest metabolic abnormality followed by hypoglycemia. Serum zinc and potassium levels were normal in all neonates.

Biochemical abnormalities were seen in 19(38.77%) cases of non metabolic seizure in neonates. Hypocalcema and hypoglycemia is commonest metabolic abnormality in Hypoxic-Ischemic-Encephalopathy and Intracranial bleed. Ultrason-ography was very effective in diagnosing cases of intracranial bleed.

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