

## NEONATAL SEIZURE: ETIOLOGY AND TYPE

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### Abstract

#### Objective

Neonates, for many reasons, are at particular risk for the development of seizures, which are a strong predictor of later morbidity and mortality in infants.

We undertook this study to determine the incidence, etiologic distribution and neonatal seizure type in neonates with hospital admission over a period of 4 years.

#### Materials and Methods

This, a retrospective study of newborns admitted in hospital with a diagnosis of neonatal seizures, was conducted over a 4 year period between March 2001 and March 2005.

Data were obtained from hospital records was analyzed using the Chi-square test.

#### Results

Of 4541 newborns, admitted to hospital, during the study period, seizures occurred in 110 neonates. The incidence of neonatal seizures was 2.4%; the causes of neonatal seizure were Hypoxic-Ischemic Encephalopathy (HIE) - 36.4%, infections -19.1%, metabolic abnormalities - 7.3%, Intra Cranial Hemorrhage (ICH) - 2.7%, structural disorders - 1.8% and in 32.7% of cases, the cause was unknown.

Subtle seizures (39.1%) were the most common type of seizures; and the other types were myoclonic (17.3%), clonic (10.0%), Tonic (7.3%), Generalized Tonic Clonic Seizures (GTCS) (12.7%) and in 13.6% of cases the type of seizure was not mentioned. Mortality rate was 13.6%.

#### Conclusion

Health care workers and parents need to be made aware of subtle seizures and the importance of timely and appropriate treatment to decrease any further complications.

**Keywords:** Neonatal seizure, incidence, type, etiology.

### Introduction

Early onset neonatal seizures are a strong predictor of later morbidity and mortality in infants (1); Neonates are at particular risk for the development of seizures, because metabolic, toxic, structural, and infectious diseases manifest more during this time, than any other period of life (2). Neonatal seizures are associated with increased rates of mortality and chronic neurological morbidity with sequelae. Sometimes neonatal seizures may be of help in identifying a treatable disorder that, if not diagnosed,

can cause permanent brain damage; hypoglycemia and bacterial meningitis, for example, can cause neonatal seizures and prompt, timely and appropriate treatment may halt further progress of the disease and prevent additional damage to the brain.

The aim of this study was to determine the incidence rate, etiologic associations and types of seizures in neonates for more precise and prompt diagnosis and treatment.

### Materials and Methods

Data for this descriptive study was based on the medical records of 110 newborn, diagnosed with neonatal seizures, and admitted in the pediatric Hospital of Bandar Abbas between March 2001 and March 2005.

All the neonates developing clinically identifiable seizures before 28 days of life were enrolled in the study. Diagnosis of neonatal seizures was based on clinical manifestations, para clinic studies (lab studies, brain imaging and EEG) and observation documented by resident doctors, pediatricians and pediatric neurologist. In all cases, an EEG was taken in the interictal phase, and those EEGs with focal or multifocal sharp waves, slow wave activity, focal or multifocal spike waves were considered abnormal, confirming neonatal seizures. All patients with diagnosis of neonatal seizure had brain imaging using CT scan or sonography.

In all cases, when seizure occurred, resident doctor or pediatrician was present there.

All residents had been trained about neonatal seizure.

For diagnosis of neonatal seizures, similar criteria were used.

Clinical type of seizure was confirmed by physicians observing the seizure; the seizure was diagnosed as a subtle seizure, if the neonate had rhythmic eye movements, chewing, rowing, swimming or pedaling movements of arms and legs.

Diagnosis of HIE was based on history, physical examination, apgar score, arterial blood gas, brain CT scan or sonography. Diagnosis of neonatal infection was based on clinical manifestations, sepsis screening tests and blood culture.

Metabolic disorders were considered as hypoglycemia (BS < 50 mg/dl), hypocalcemia (Total serum Ca<8mg/dl in full term, and Ca<7 mg/dl in premature neonates),

hyponatremia (Na <130 mg/dl) hypernatremia (Na > 150mg/dl), and hypokalemia (K<3mg/dl). If two of the following findings, i.e. dysmorphic face, unusual body odor, hypersomnolence, unexplained vomiting, a positive history death in siblings, and abnormal blood gas analysis and hypoglycemia, were seen in patients having seizures, they had complete a metabolic disease workup to confirm any inborn errors of metabolism.

Intracranial hemorrhage (ICH) and structural disorders were diagnosed by CT scanning or brain sonography.

All information required for study analysis, was taken from the medical records and recorded in a data sheet; this included antenatal history, i.e. gestational age, history of maternal illness during pregnancy and natal history, labor records for evidence of fetal distress and Apgar score, type of delivery and age, gender, birth weight and head circumference of newborn.

Chi-square test was used for data analysis and  $p<0.05$  was considered significant.

### Results

The results showed that of 4541 neonates admitted with during a 4-year period, 110 (2.4%) had neonatal seizures; 64 were male (58.2%) and 46 female (41.8%). There was a significant relationship between occurrence of seizures and sex. ( $p<0.05$ )

Thirty-two (29.1%) neonates had seizures in the first 24hr of their life, 28 (25.5%) on the second and third days of life, 14(12.7%) between the 4<sup>th</sup> to 6<sup>th</sup> days of life and 36 (32.7%) on the 7<sup>th</sup> day or later. Over half the neonates (54.6%) hence had seizures within the first 72hrs of their life. The average age of patients suffering from seizures was 7.9 days.

Birth weight of 81 newborns (73.6%) was normal (2500gr-4000gr), 25 (22.7%) had low birth weight (<2500gr) and 4 (3.6%) were large babies (birth weight > 4000gr).

Head circumference of 78.3% of newborns was between 32 cm and 37 cm, 10% less than 32 cm and 2.7% more than 37 cm. Of newborns, 83.6% were term (G.A37w-40w), 12.7% were preterm (G.A<38w) and 3.6% were post term (G.A>42w).

The type of delivery in 65.6% of cases was Normal Vaginal Delivery (NVD) and in 34.5% was Cesarean Section (C.S).

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Apgar score of 70.9% of neonates within 5 minutes was above eight, 25.5% between 5 and 8, and 3.6% was below 5. Ninety percent had prenatal care.

In this study the most common etiology of neonatal seizures was HIE (36.4%) followed by infections (19.1%), metabolic disorders and inborn errors of metabolism (7.3%), Intra Cranial Hemorrhage(ICH) (2.7%) and structural disorders (1.8%); in thirty six cases (32.7%) the etiology was not defined (Table 1).

The most common type of seizures observed in our study

was subtle (39.1%); the other types seen were myoclonic (17.3%), Generalized Tonic Clonic Seizures (GTCS) (12.7%), clonic 10%, tonic 7.3%, and in fifteen cases (13.6%) type of seizure was not mentioned (Table 2).

Mortality rate in our study was 13.6% (15 cases, 10 male and 5 female); the most common etiology leading to death was HIE (60%), followed by infection (20%) and ICH (6.7%); in 13.2%, the etiology of death was not mentioned.

Table-1 Prevalence and percentage of causes of neonatal seizures

Etiology prevalence	HIE	Infection	Metabolic disorders & Inborn Errors	ICH	Structural Disorders	Unknown	Total
<b>Number of cases</b>	40	21	8	3	2	36	110
<b>Percentage</b>	36.4	19.1	7.3	2.7	1.8	32.7	100

Table-2 Prevalence and percentage of types of neonatal seizures

Type Prevalence	Subtle	Myoclonic	GTCS	Clonic	Tonic	Unknown	Total
<b>Number of cases</b>	43	19	14	11	8	15	110
<b>Percentage</b>	39.1	17.3	12.7	10	7.3	13.6	100

### Discussion

The incidence of neonatal seizure in our study was 2.4% (24/1000 patient). Sheth RD et al in Wisconsin found that the incidence of neonatal seizures, admitted in NICU were 8.6% (86/1000 patients) (3), while but the incidence rate in Kentucky was 3.5/1000 live births, in Canada 2.5/1000, in Texas 1.8/1000, and in Minnesota 1.1/1000 live births (4). Our study investigated newborns, admitted in the NICU and neonatal wards, which is why the incidence rate of seizures was higher than those of other studies, performed on live birth newborns. However the incidence of neonatal seizures in our study was lower than that reported for Wisconsin; the higher incidence rate of neonatal seizures in Wisconsin was because the newborn admitted in NICU has more underlying diseases/conditions that make him/her susceptible to neonatal seizures e.g. prematurity, sepsis or IVH. The most common etiologies of neonatal seizure in our study were HIE, infections and metabolic disorders respectively.

In the Ronen study the etiologies of neonatal seizure were HIE 40%, infections 20% and metabolic disorders 19% (5). In Arpino's study also, HIE was the most common etiology of neonatal seizures (30%) (6).

As documented in literature available, the most common cause of neonatal seizure is HIE (2, 5-7), results that are in agreement with ours.

In our study the most common type of seizure was subtle (39.1%), followed by myoclonic 17.3%, GTCS 12.7%, clonic

10%, tonic 7.3%, and in 13.6%, the type of seizure was not mentioned.

In the Martinez study from Spain, types of neonatal seizure were subtle 42% tonic 33.9%, myoclonic 16.1% and clonic 10.7%(8); Ross reported percentages of subtle 40.6% clonic 35.59%, myoclonic 27.72% and GTS 8.9%(9); however GTCS was reported as the most common type of seizures 29% in the Arpino study (6).

One study reports subtle seizures as the most common subtype, comprising about half of all seizures in term and preterm newborns (7).

We found just one study that was reported GTCS as the most common type 27% (6). Mortality in our study was 13.6% which was higher than that reported in Ronen's study (9%) (5); this higher rate could be due to the relatively poor patient management in the province's referral hospital. In this study, the highest occurrence of seizures was within the first 24hrs of life (29.1%). HIE and infections are the most common causes of mortality in newborns who have neonatal seizures, usually occurring on the first day of life (28.1%). Hence availability of close supervision, prompt and precise prenatal care and treatment of maternal infections, to prevent neonatal infections can lower these rates; increased awareness of mothers to avoid high risk pregnancies can be instrumental.

To conclude it is vital to educate parents and health care providers to be able to distinguish a subtle seizure, one of the most common type of seizure from baby's normal movements.

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