Russian State Medical University, Moscow, Russia
Diagnostics of neonatal seizures
by the amplitude-integrated EEG in the intensive care unit
V.V. Abalova, O.V. Grebennikova, M.G. Degtyareva, M.I. Medvedev, A.N. Zavadenko
Department of Neonatology, Postgraduate Faculty, Moscow Municipal Hospital №8

INTRODUCTION

Neonatal seizures (NS) are the most distinctive neurological dysfunctions in the neonatal period, especially in NICU patients.
Many studies have shown the most unfavorable outcomes in infants with therapy resistant NS and seizures accompanied by severe EEG background patterns.
Accurate diagnosis and timely and controlled therapy of NS allows to avoid unfavorable outcomes including antiepileptic therapy side effects. Several studies have shown that the majority (80-85%) of NS are subclinical. However, recent studies using synchronized video-EEG monitoring have demonstrated that less than 10% of NS are correctly identified by neonatologists. Therefore EEG confirmation is essential in cases of suspected NS to verify their epileptic characteristics.

NEONATAL SEIZURE CLASSIFICATION

- Tonic (focal, generalized)
- Clonic (focal, multifocal, generalized)
- Subtle (eye deviation, fixed open stare; chewing, tongue thrusting; cycling, boxing, pedalling limb movements; apnea, etc.)
- Mioclonic (focal, generalized)
- EEG-positive seizures

Conventional EEG   *aEEG*

OBJECTIVE

OBJECTIVE of the study was to identify the reliability of amplitude-integrated EEG (aEEG) in the diagnostics of NS in NICU.

PATIENTS

- 76 newborns with gestational age 22-41 weeks (31.3±4.4 weeks)
- birth weight 450-4940 g (1715±826 g)
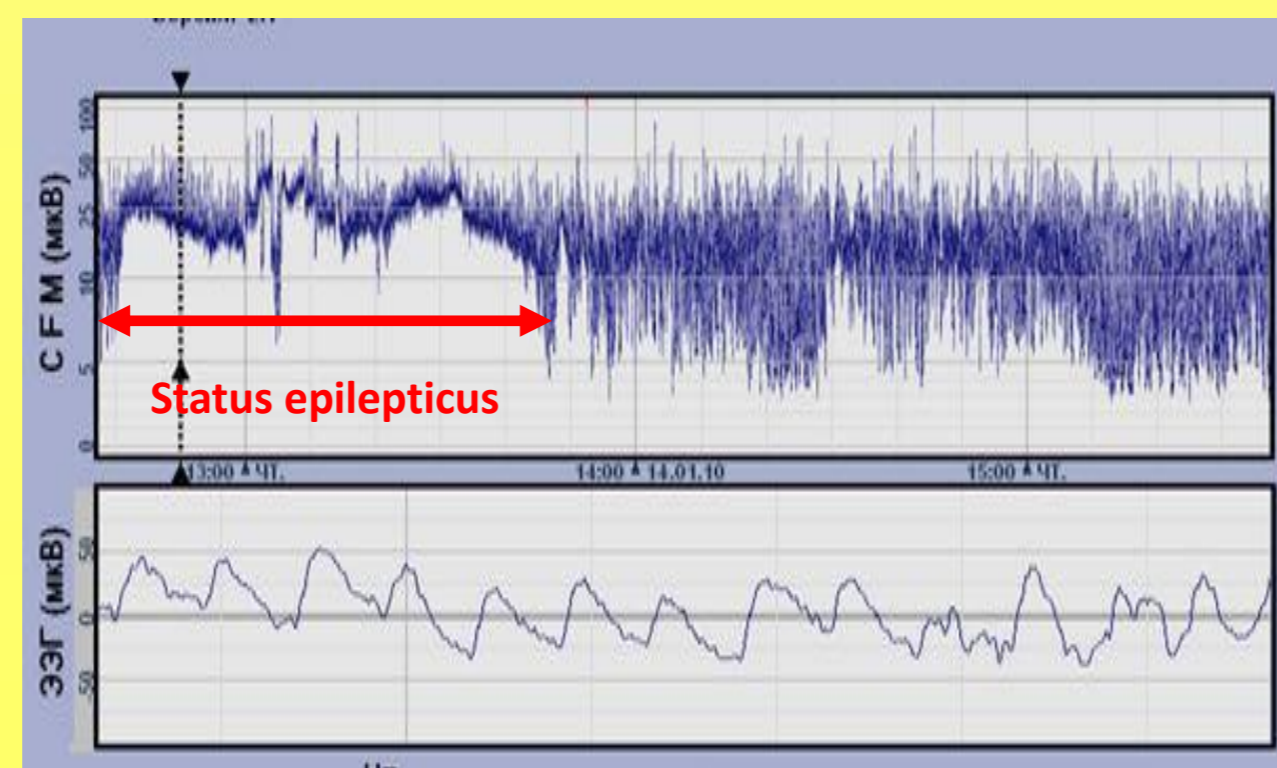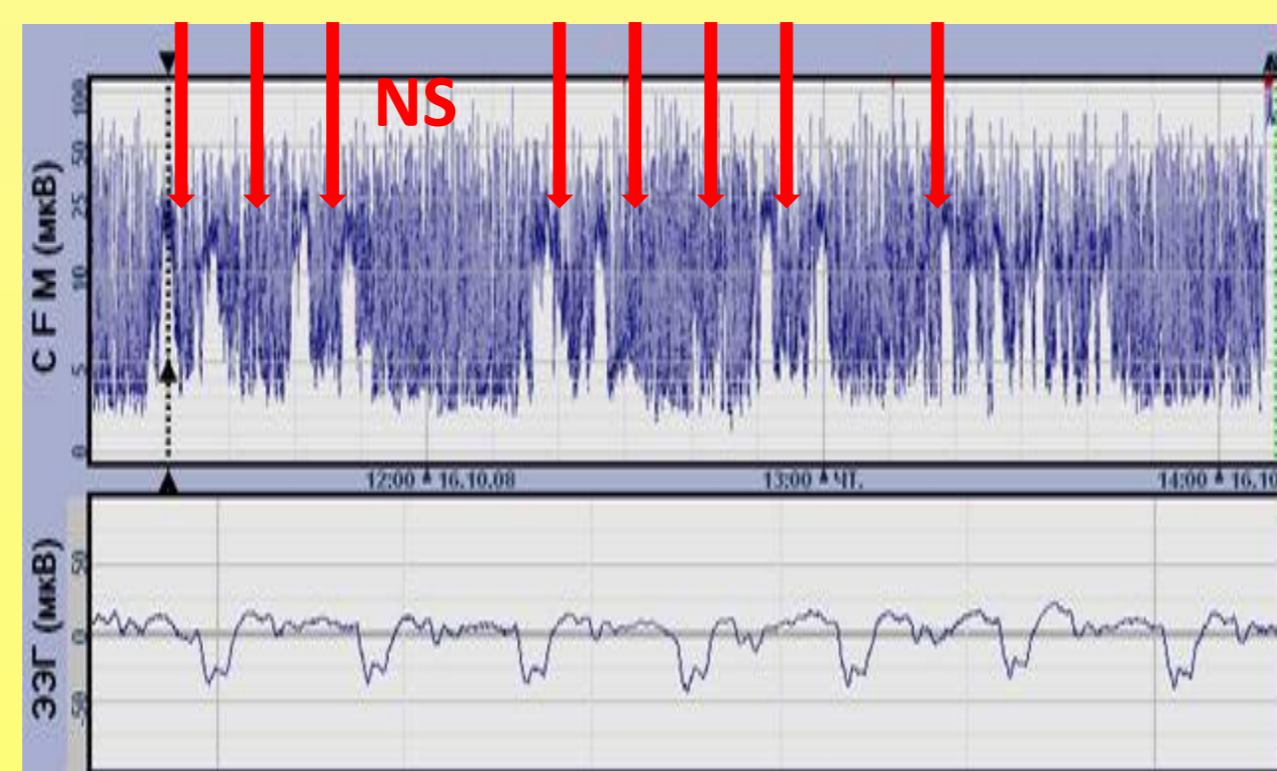- moderate or severe perinatal brain damage

METHODS

- Neonates underwent 24 hours of EEG-monitoring (Olympic CFM 6000, frontal electrode placement)
- Cranial ultrasonography
- CFM recordings were evaluated using V.Burdjalov's scoring scale, 2003.

ELECTROGRAPHIC IDENTIFICATION OF SEIZURE ACTIVITY

- Seizure results in a transient rise of the aEEG amplitude, maximum and minimum border, or sometimes only the minimum border.
- A seizure pattern in the simultaneous raw EEG is characterized by sudden repetitive, stereotyped waveforms (spikes, sharp waves, spike-slow-wave complexes, rhythmic theta or delta activity without sharp components) with a definite onset, peak, and end and a minimum duration of 10 sec.
- Status epilepticus is continuously ongoing ictal activity or recurrent seizures of at least 30 minutes duration, or more than 50% of the EEG recording time.
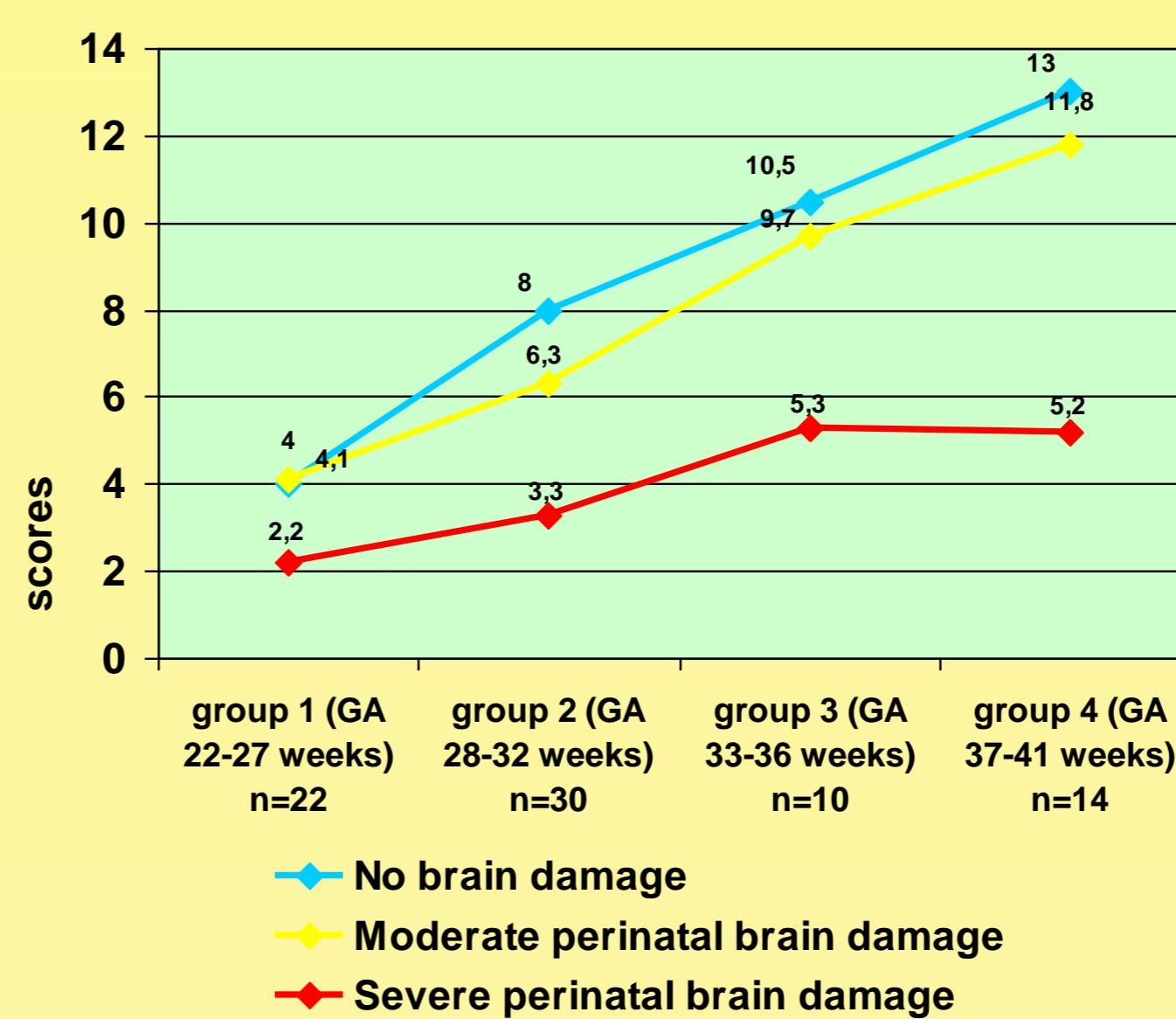

RESULTS

Correlation between aEEG confirmed seizure incidence and severity of perinatal brain damage

aEEG confirmed seizures were detected in 84% of cases with severe perinatal brain damage, while in cases of moderate perinatal brain damage there was a high incidence of unclear aEEG-patterns.
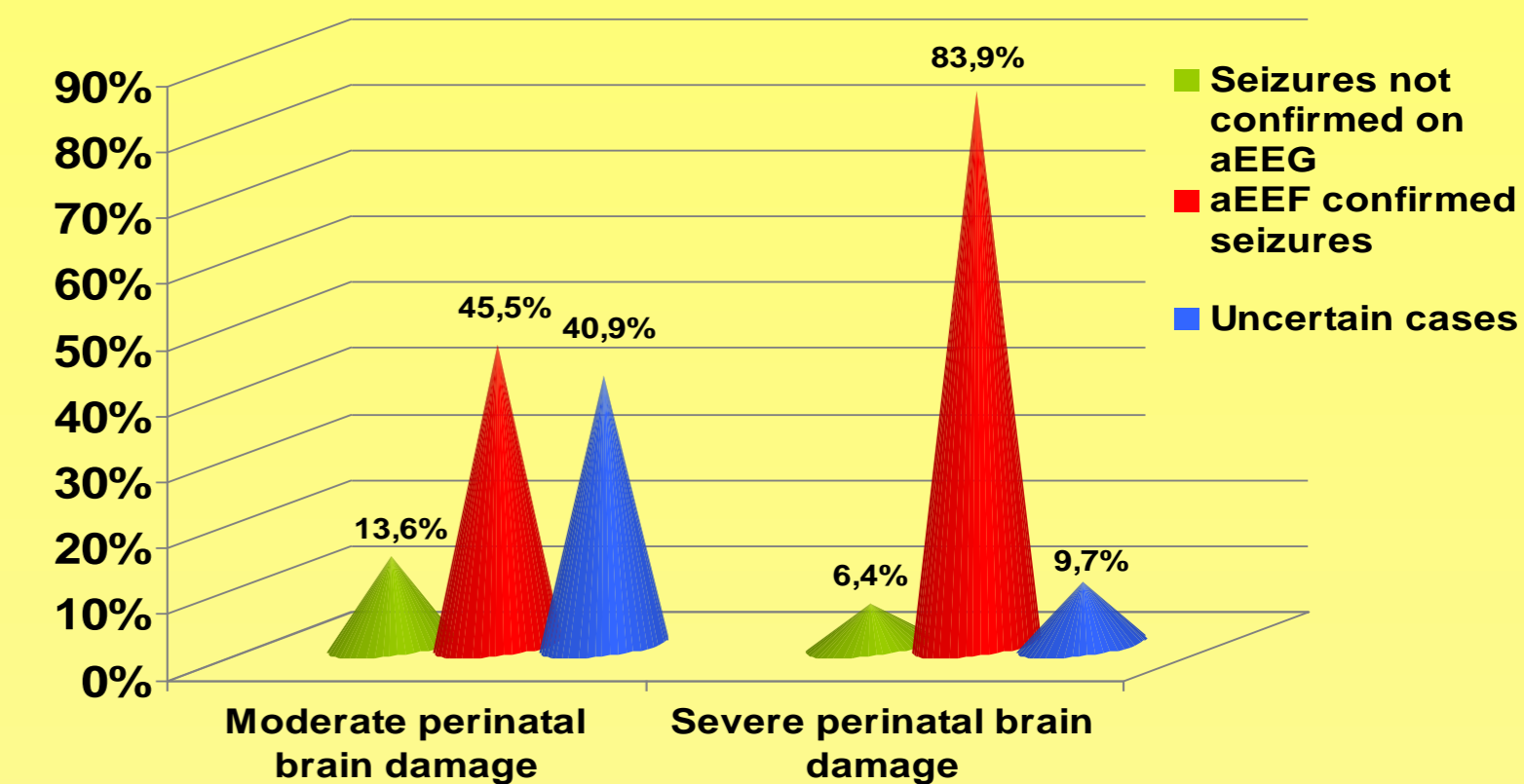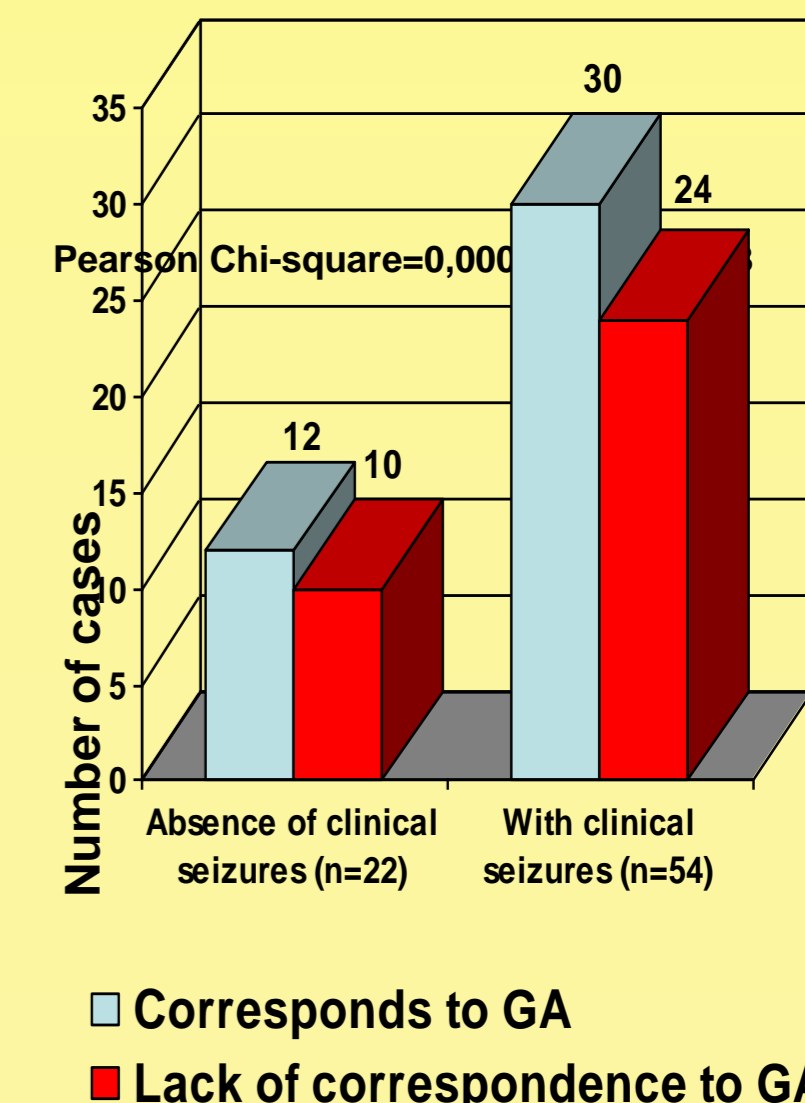

Pearson Chi-square=11.6 df=2 p=0.003

Correspondence between V.Burdjalov's scores in groups of patients with different GA and severity of perinatal brain damage


Correspodence between V.Burdjalov's scores and GA in relation to presence of clinical NS

Degree of CNS functional maturity by Burdjalov's scoring scale did not reach standard referential data in any case of perinatal brain damage. The score was significantly higher in more matureinfants; in patients with similar GA the score was significantly less in infants with more severe perinatal brain damage. However, there was no correlation between maturity of cerebral activity and the presence of clinical signs of NS.

Relationship between presence of clinical signs of NS and aEEG data

Total No. = 76, GA 22-41 weeks
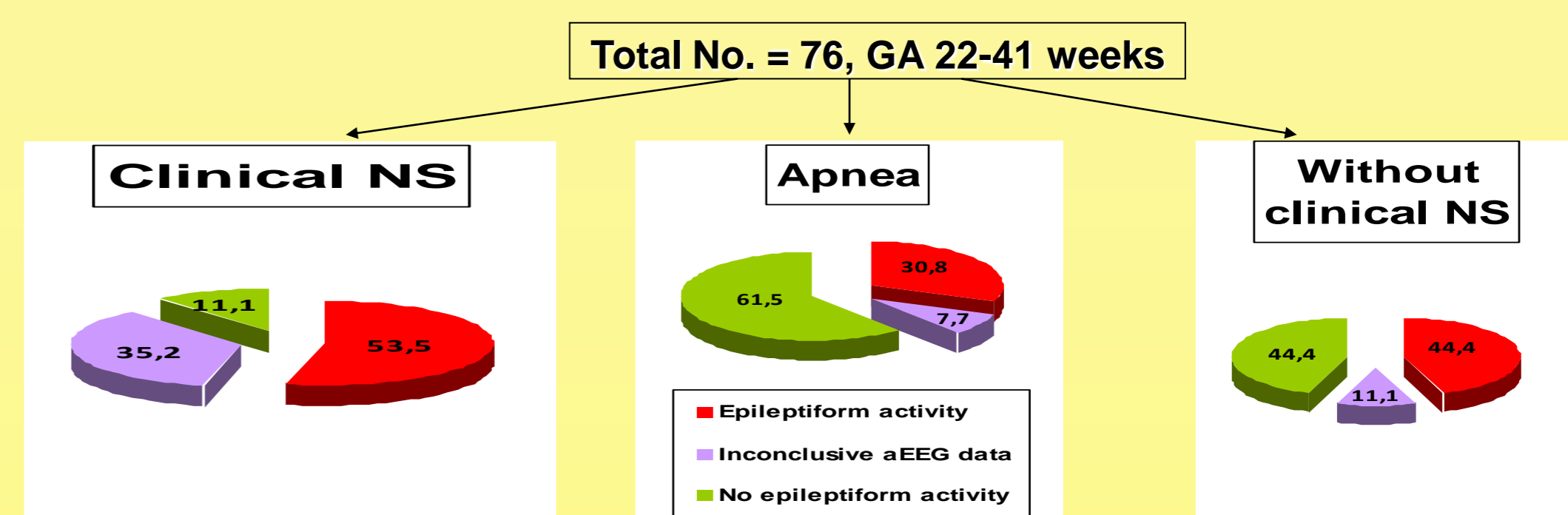
Among 54 newborns with clinically manifested NS epileptiform activity was registered in 29 (53.7%), aEEG data were inconclusive in 15 cases (35.2%) (due to motor artifacts or dissociation between seizure markers and aEEG seizure pattern), epileptiform activity was not registered in 6 cases (11.1%).
Among 9 (11.8%) infants without clinically manifested NS epileptiform activity was observed in 4 cases (44.4%), aEEG data were uncertain in 1 case (11.1%) and there was no epileptiform activity in 4 (44.4%) cases.
13 (17.1%) newborns had apnea that required differentiation with atypical NS. In this subgroup epileptiform activity was detected in 4 (30.8%) neonates, aEEG data was inconclusive in 8 cases (61.5%), and there was no epileptiform activity in 1 case (7.7%).
Dissociation between clinically manifested NS and NS determined by aEEG was observed in 11 (14.5%) infants. It was not possible to make a reliable conclusion via aEEG, i.e. to confirm or exclude NS in 24 (31.6%) cases.

CONCLUSIONS

aEEG is an important tool in diagnostics of NS and differentiation of NS from non-convulsive conditions. Video-EEG monitoring is indicated in cases of dissociation between clinically manifested NS and aEEG diagnosed NS or uncertain data.