

II. NEONATOLOGY

PERIVENTRICULAR LEUKOMALACIA ECHOGRAFICAL AND CLINICAL DIAGNOSIS

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Abstract

Periventricular leukomalacia is a relative frequent disease amongst premature newborns with severe hypoxic disorders at birth. The authors aimed to analyze, in this workout, the most involved risk factors, neurological and clinical scene and their concordance with imagistical methods used.

Key words: periventricular leukomalacia, newborn.

Introduction

Periventricular leukomalacia (PVL) is a ischemic necrosis of the white periventricular substance near the external angles of the lateral ventricles. The ending branches of the main vessels are leading to this region and, therefore, makes it more predisposed to ischemic necrosis. By microangiographic techniques it was shown that infarction is localized at the limit between afferent branches of middle cerebral artery and efferent branches of choroidal artery. The primary lesion is coagulating necrosis; after 5 – 7 days begins the necrotized tissue phagocytosis, which is finalized after approx. 2 – 3 weeks, leading to a cavity.

Material and method

The study was developed in the Premature and Neonatology Clinic of the “Louis Turcanu” Children Hospital, during 10 years: 1999 – 2008. The studied contingent included a number of 50 premature newborns selected from 212 infants with severe hypoxic disorders at birth. The including criteria for

the study were anamnestic, clinical and imagistical criteria.

Results and Discussions

Periventricular leukomalacia (PVL), profound infarction of the white substance near the external angles of the lateral ventricles, was found at 50 cases (23,58%). Its high prevalence in premature newborns is in accordance with the literature data; is known that 80 – 90% of cases appears at premature infants. Also, the localization of the lesion was typical, at the limit between afferent and efferent branches of the cerebral arteries, at 3 – 10 mm from the ventricular wall.

In the affection appearance, severe hipoxia, both in prenatal, perinatal and neonatal period, was constantly involved:

- prenatal appearance of the affection at 31 cases (matern-fetal infections, utero-placental affections, green amniotic liquid, membrane rupture after 72 hours, Apgar score <7);
- at 26 of cases prenatal factors were associated with other affections, that influenced the neuropathological and clinical table: sepsis, repeated crisis of apnea, bradycardia, bronchopneumonia, Patent Ductus Arteriosus.

The premature newborns included in this lot have clinically presented an intense neurological table, with: severe hypotonia, repeated crisis of apnea, archaic reflex diminution – especially at lower limbs, convulsions (see table).

Clinical signs	Number of cases	Percents %
Hypotonia	33	70,00
Repeated crisis of apnea	42	84,00
Archaic reflexes diminution/abolition	43	86,00
Hiperexcitability	15	30,00
Convulsions	14	28,00
Opisthotonus	12	24,00

The intensity and duration of the clinical signs were higher in cases of PVL associated with periventricular or intraventricular hemorrhage (especially in severe forms). Associated ultrasound hemorrhagic lesion was found in 21 cases (42,00%), 9 of them with germinal matrix localization and 12 with intraventricular localization.

Ultrasound diagnosis of PVL was based on the characteristics and the localization of the lesion: echogenic large band laterally positioned to the anterior horns of the lateral ventricles and to the trigones of the lateral ventricles. The hyperechogenicity in the anterior portion of the lateral ventricles has a typical localization which is localized on the antero-external side of them.

The ultrasound examination was done weekly and monitored the following aspects of the hyperechogenicity: intensity, dimension, localization, outline, homogeneity relation with the ventricular system. The echogenic intensity of the lesion has importance in order to appreciate severity and prognosis, especially in cases in which the evolution was towards cystic formations:

- 23 of cases (53,48%) were easy forms which presented periventricular echogenicity with an intensity lower than that of the choroid plexus and dimensions smaller than those of the lateral ventricular trigone;
- 8 cases (18,60%) were moderate forms which presented periventricular echogenicity with an intensity similar to that of the choroid plexus and approximately equal dimensions to those of the lateral ventricular trigone;
- 12 cases (27,90%) were severe forms which presented periventricular echogenicity higher than that of the choroid plexus and dimensions bigger than those of the lateral ventricular trigone.

The echogenity evolution was: resorption – 9 cases, cystic formations-34 cases (fig. 1).

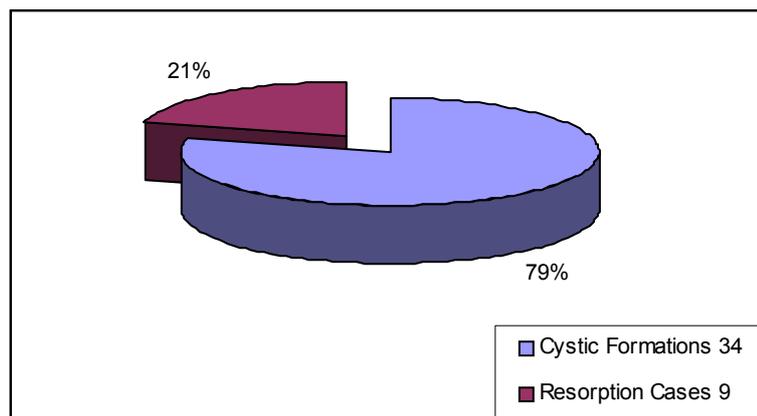


Fig. 1. Evolution of the hyperechogenical formations in periventricular leukomalacia.

The visualized cystic formations were diagnosed based on echographic characteristics: transonic formations with homogeneous contents, homogeneous echogenicity of the contents, thick walls (echogenic intense), unique in 22 cases and multiple in 19 cases. As time of appearance (excepting the cystic formations found at the first examination) the first formations were visualized at three weeks from the founding of echogenities.

Positioning of the cysts – in the anterior region (external angle of the lateral ventricles) – 37 cases;

posterior region (posterior side of the lateral ventricles) – 7 cases and only in 6 cases were found cystic formations along the entire border of the lateral ventricles (fig. 2). The anterior – extern positioning of the lesions to the anterior horns of the lateral ventricles was confirmed by the literature (Volpe J.J. 1992); these areas are known to be susceptible to perfusion pressure and cerebral blood pressure decreasing and, therefore, leading to specific leukomalacia lesions.

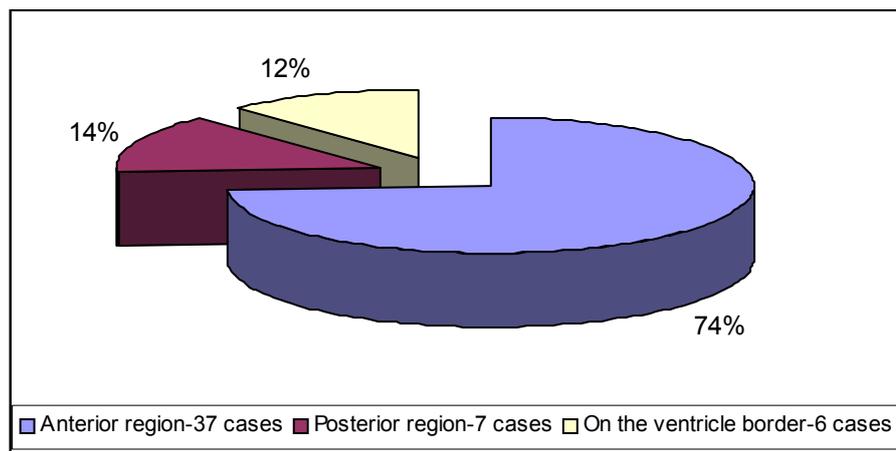


Fig. 2. Positioning of the cystic formations.

The dimensions of the cystic formations are important in order to establish the prognosis and the neurological modifications in time. The cystic formations diameters were between 3 and 12 mm. The high echogenity (moderate and severe forms of the disease) were followed by big cysts, usually multiples (20cases-48,78%). The severe clinical table was found in these cases: recurrent convulsive syndrome (22 cases), severe hypotonia (8 cases), spasticity of the inferior limbs (11 cases) and opisthotonus (14 cases).

Generally, the medium periods of persistence were: echogenity between 1 and 3 weeks and cystic formations between 3 week and 3 months. At severe forms transonic lesions and ventriculomegaly persisted until the age of 8-10 months.

At the cases where the cystic formations persisted we have visualized the following aspects:

- cystic formations – 3 cases
- cystic formations accompanied by ventriculomegaly – 6 cases
- ventriculomegaly – cerebral atrophy – 16 cases

The diagnosis of cerebral atrophy was based on ventriculomegaly accompanied by the increase of the interhemispheric space and the increase of the distance between the gyrus in the anterior region.

The rupture of the septum between the cysts and the lateral ventricles produced the evolution towards ventriculomegaly.

The cases in which the persistence of cystic formations was associated with cerebral atrophy, the following severe neurological modifications were found:

- recurrent convulsions- 16 cases;
- spastic dyplegia- 9 cases;
- sight disorders – 4 cases;
- speaking disorders –3 cases;

- hearing disorders – 3 cases;
- mental retardation –22 cases;
- minimum cerebral dysfunction –10 cases.

The specialty literature data referring to neurological disorders after PVL are varied. A study done by Pidcock and his collaborators on a lot of 127 premature newborns showed that there is a significant correlation between the appearance, dimension and localization of the cysts and the appearance of a mental disorders. From the studied cases, 42 did not show cystic formations in evolution and had a good neurological evolution unlike the 25 cases with moderate cystic lesions and 20 cases with severe cystic lesions, which developed neurological disorders in 32% and 90% of cases.

The association between PVL and periventricular and intraventricular hemorrhage is discussed a lot in the specialty literature. American authors observed associations in 28-59% of cases. In the lot that we studied there were hemorrhagic lesions (42%):

- in 9 cases subependymal hemorrhages;
- in 12 cases intraventricular hemorrhages.

The distinction between the hemorrhagic and non-hemorrhagic PVL was difficult to prove based on echography, because the echogenity has the same characteristics.

The presence of hyperechogenic lesions inside the non-dilated ventricles and in the cerebral intraventricular parenchyma (laterally from the anterior region, the posterior region and along the ventricular wall) oriented the diagnosis towards PVL associated with an intraventricular hemorrhage.

In the presence of big lesions in the cerebral parenchyma, accompanied by hyperechogenity inside the lateral, dilated ventricles, the distinction between

the hemorrhagic and non-hemorrhagic forms was very difficult to make, these forms being the severe forms of intraventricular hemorrhage (IV degree).

Conclusions

1. The moment of action upon the CNS was both in the ante and intranatal period, and in the neonatal period. The risk factors were: the Apgar score < 7 (84,43%), the presence of meconium in the amniotic liquid, uterus-placental lesions, long labor. In the majority of cases there were 2 or more risk factors.
2. The clinic and echographic table was different according to the intensity and length of the injury: 53,48%- easy forms, 18,60%- moderate forms, and 27,90% severe forms.
3. The cystic formations appeared in the evolution of most cases (79,05%) in the hyperechogenic area. Big cysts, usually multiple, followed the big echogenities. In this situation, in 48,78% of the cystic formations, the clinical table was severe.
4. The evolution towards cerebral atrophy (32%) consisted of the following aspects: the growth of the interhemispheric space, the growth of the distance between the gyri, the accentuated hyperechogenicity of these spaces, especially in the anterior region and the slow ventriculomegaly.
5. The persistence of the cystic formations (56,09%) and/or the presence of the echographical signs of the cerebral atrophy (32%) was correlated to the appearance of the neurological disorders: convulsive recurrent syndrome (32%), infantile spastic diplegia (18%), sight disorders (8%), hearing disorders (6%) and neuropsychomotor retardation (44%).
6. The periventricular and intraventricular hemorrhage was associated in 42% of cases, the distinction being difficult in the presence of a big hyperechogenic lesion localized inside the lateral ventricles and in the parenchyma.

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