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"CLINICAL COURSE AND OUTCOMES OF INTRAVENTRICULAR HEMORRHAGE IN PRETERM INFANTS WITH COMBINED PERINATAL PATHOLOGIES"

Hojimatova M.Sh.,
Mannopov A.

Abstract: "This article presents an analysis of the frequency, pattern, and outcomes of intraventricular hemorrhage (IVH) in preterm infants with combined perinatal pathologies. A prospective study of 28 preterm infants with IVH confirmed by neurosonography was conducted. The study group comprised 15 (53.6%) boys and 13 (46.4%) girls with gestational ages ranging from 26 to 34 weeks. All patients presented with concomitant conditions, including ABO hemolytic disease of the newborn (HDN), hepatic encephalopathy, and respiratory distress syndrome (RDS). IVH grades I–II were most frequently observed (67.8%). Severe IVH (grades III–IV) was associated with HDN and hepatic encephalopathy and demonstrated a significantly higher rate of adverse neurological outcomes ($p < 0.05$). The mortality rate in the study group was 17.8%."

Keywords: preterm infants, intraventricular hemorrhage, hemolytic disease of the newborn, hepatic encephalopathy, neurosonography, neurological outcomes.

Introduction

Intraventricular hemorrhage (IVH) remains one of the most common and severe neurological complications of the neonatal period in preterm infants and is a leading cause of mortality and disability [1]. The main pathogenetic basis of IVH is the immaturity of the germinal matrix—a richly vascularized embryonic tissue located subependymally [2]. Risk factors for IVH include low gestational age, respiratory distress syndrome, fluctuations in systemic arterial and cerebral perfusion pressure, coagulopathies, and hypoxemia [3].

The problem of IVH is especially relevant in preterm infants with combined perinatal pathology, such as ABO hemolytic disease of the newborn (HDN) and hepatic encephalopathy. HDN, accompanied by severe hyperbilirubinemia and hemolytic anemia, may exacerbate blood–brain barrier damage and potentiate hypoxic–ischemic brain injury [4]. Hepatic encephalopathy, in turn, leads to severe metabolic disturbances and coagulopathy, creating additional risks of hemorrhagic complications [5]. The aim of this study was to analyze the course and outcomes of IVH in preterm infants with combined pathology (ABO HDN, hepatic encephalopathy, etc.).

The study included 28 preterm infants who were treated in the intensive care unit between 2023 and 2024. Inclusion criteria: gestational age < 35 weeks, IVH confirmed by neurosonography, presence of one or more concomitant diseases (ABO HDN, hepatic encephalopathy, RDS).

Methods

1. Neurosonography (NSG) was performed within the first 72 hours of life, on days 7 and 14, and as needed, through the anterior fontanelle using a Philips Sparq device. IVH grading followed the Papile classification [6]:
   - Grade I: Germinal matrix hemorrhage
   - Grade II: IVH without ventricular dilatation
   - Grade III: IVH with ventricular dilatation
   - Grade IV: Parenchymal hemorrhage
2. Laboratory tests included CBC, biochemical panel (bilirubin fractions, ALT, AST, urea, creatinine), and coagulation profile.

Outcome assessment: mortality and neurological status at discharge were evaluated.

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Statistical analysis: Data were processed using SPSS 26.0. Chi-square test (χ^2) was used. Differences were considered statistically significant at $p < 0.05$.

Results: patient characteristics: mean gestational age — 30.4 ± 2.5 weeks, mean birth weight — 1450 ± 450 g. Sex distribution: 15 boys (53.6%), 13 girls (46.4%).

Table 1. Structure of concomitant pathology in the observed newborns (n = 28)

№	Concomitant disease	Absolute number	%
1	Respiratory distress syndrome (RDS)	28	100%
2	Hemolytic disease of the newborn (ABO)	9	32.1%
3	Hepatic encephalopathy	6	21.4%
4	Necrotizing enterocolitis (NEC)	4	14.3%
5	Patent ductus arteriosus (PDA)	11	39.3%

Association between IVH severity and concomitant pathology: among 9 children with ABO HDN, 6 (66.7%) had grade III–IV IVH.

All 6 infants with hepatic encephalopathy had grade II–IV IVH, of whom 4 (66.7%) had severe IVH (III–IV).

Statistical analysis confirmed a significant association between ABO HDN/hepatic encephalopathy and the development of severe IVH ($p < 0.05$).

Mortality was 7.1% (2 infants), both cases associated with severe combined pathology (grade IV IVH + hepatic encephalopathy + sepsis).

Discussion: the study demonstrates that preterm newborns with combined perinatal pathology present with specific features of IVH progression. The high frequency of severe IVH (grades III–IV) in infants with ABO HDN and hepatic encephalopathy aligns with findings of other authors [4, 5, 7].

Pathogenetically, the association between HDN and IVH is complex:

- Severe anemia leads to systemic and cerebral hypoxia, increasing vessel fragility in the germinal matrix.
- Elevated indirect bilirubin levels exert cytotoxic effects and damage the blood–brain barrier, disrupting cerebral hemodynamics [4].

Neonatal hepatic encephalopathy aggravates the condition through:

- Coagulopathy (reduced synthesis of coagulation factors)
- Accumulation of neurotoxins such as ammonia

This creates a “double hit” to the immature brain — increased bleeding risk and direct metabolic neurotoxicity.

Clinical implications:

1. Early treatment of HDN — intensive phototherapy, exchange transfusion if indicated.
2. Correction of coagulopathy — vitamin K, fresh frozen plasma.
3. Gentle respiratory therapy — minimize fluctuations in cerebral perfusion.
4. Enhanced neuro-monitoring — daily NSG during the first 3–5 days for high-risk infants.

Conclusion: the presence of concomitant pathology, such as ABO hemolytic disease and hepatic encephalopathy, is an unfavorable prognostic factor that significantly increases the risk of severe (grade III–IV) intraventricular hemorrhage in premature newborns. A comprehensive approach including active management of underlying conditions, careful monitoring of coagulation and cerebral hemodynamics, and regular neurosonography improves the early detection of high-risk infants and enhances neurological outcomes.