



RISK FACTORS OF INTRAVENTRICULAR HEMORRHAGE IN NEONATES BORN BEFORE 34 WEEKS OF GESTATION- RETROSPECTIVE STUDY

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ABSTRACT

Introduction: IVH is characterized by abnormal bleeding from blood vessels into the ventricles of the brain, predominantly found in infants born prior to 34 weeks of gestation. Associated risk factors of IVH in premature neonates were assessed to build a base for the development of prevention strategies. **Material and methods:** A retrospective study were conducted at the neonatal intensive care unit (NICU) of the BAL GOPAL CHILDREN HOSPITAL, BYRON BAZAR, RAIPUR, CHHATTISGARH between august 2020 and august 2021. Neonates born before 34 weeks of gestation and admitted to level 3B NICU were included and Neonates born after 34 weeks of gestation, suspected TORCH infection, Congenital anomalies, Syndromic baby and neonates with any surgical conditions were excluded. **Result:** The incidence of IVH was found to be 24.5%. The lower the birth weight, higher was the risk of IVH ($p= 0.0125$). The incidence of IVH was higher in neonates: born by spontaneous vaginal delivery, presented with asphyxia, neonates who developed apnea, neonates with acidosis and with anaemia. There was no significantly increased risk of IVH in neonates: those who were treated for hypotension, presence of PDA, seizure, RDS and maternal risk factors like hypertension, hypothyroidism, gestational diabetes mellitus, PROM. **Conclusion:** There is no absolute treatment of IVH is available, identifying risk factors is important for the development of effective prevention strategies of IVH.

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INTRODUCTION

IVH is characterized by abnormal bleeding from the blood vessels to the ventricles of the brain, which are most common in babies born before 34 weeks of gestation. Since these babies are born at a critical time in brain development, they can develop mild neurological, emotional, mental and motor impairment depending on the size of the IVH. The stage of IVH grade IV, is approximately 27% in neonates weighing less than 1500 gm¹. It is one of the leading causes of cerebral palsy and mental retardation, with cases ranging from 15-40 per cent². Factors related to the risk of IVH in premature neonates were examined to form the basis for the development of preventive strategies.

METHODS

Study design and patient details

The retrospective study is being conducted in the NICU's BAL GOPAL CHILDREN HOSPITAL, BYRON BAZAR, RAIPUR, CHHATTISGARH between August 2020 and

August 2021. Neonates are born after 34 + 0 weeks of pregnancy. Neonates have a suspected TORCH group of infections (toxoplasmosis, other, rubella, cytomegalovirus, herpes), Neonates born with Congenital anomalies, Syndromic child and neonates with any surgical conditions excluded.

A diagnosis of intra-intra-intraventricular hemorrhage was obtained using a cranial ultrasonographic scan. According to the American Academy of Neurology (AAN) guidelines, a standard ultrasonographic cranial scan is performed on the third, seventh day of life, and just before discharge from the hospital. Intraventricular hemorrhage classification was based on the Papille IVH grading.³

Aim

To determine the incidence, outcome and analyse neonatal and maternal risk factors of intraventricular hemorrhage (IVH) in preterm neonates (gestational age <34 weeks).

Objectives

1. To determine the incidence and outcome of IVH among the admitted all preterm newborn
2. To determine neonatal and maternal factors of all premature neonates admitted during august 2020 to august 2021 in BAL GOPAL CHILDREN HOSPITAL, BYRON BAZAR, RAIPUR, CG.

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In our NICU TC-USG standard protocol for all preterm delivered before 34 weeks of gestation. IVH was diagnosed on the basis of the findings of TC-USG. All TC-USG scans are performed by a single radiologist. Transducers of 1 to 6 MHz (LOGIQ 6; GE) were used to perform ultrasound on sagittal and coronal planes. Data extracted from medical records and the NICU register were checked to ensure the accuracy of the information.

Our study examined the following risk factors for IVH in premature babies born before 34 weeks of gestation; mode of delivery, gestational age, child sex, birth weight, apnea, anemia, elevated blood pressure in pregnancy, gestational diabetes, thyroid disease, PROM, respiratory disease, use of inotropes/hypotension, presence of PDA and the end result.

All statistical analysis is done using the software IBM SPSS version 23 and the online website <https://www.socscistatistics.com/>

RESULT

The incidence of IVH was found to be 24.5% (49 out of 200) where the female child was (53%) and the male child (47%) without statistical significance (p = 0.73). IVH status is strongly associated with low birth weight (p = 0.0125) and low gestational age (p = 0.001). Decreased age of pregnancy was a major risk factor for IVH. IVH incidence in neonates born <28 weeks of gestation (41.2%), 28-32 weeks of gestation (17.2%), 32- 34 weeks of gestation (12%). IVH incidence in neonates born with birth weight <750gm (50%), 750 - 1000gm (29.6%) and birth weight between 1000gm - 1500gm (13%). With lower birth weight, there was a higher risk of IVH (p = 0.0125). IVH incidence was higher in neonates: (1) born with vaginal delivery (p = 0.001), (2) neonates presented with asphyxia (p <0.001), (3) neonates developed apnea (p = 0.034), (4) neonates with acidosis treated with NaHCO3 (p = 0.014), (5) neonates with anemia (p = 0.001). There was no increased risk of IVH in neonates: (1) those with hypotension/inotropes use (p = 0.6), (2) newborns with PDA (p = 0.097), (3) neonates who developed seizures (p = 0.29), (4) neonates presented with RDS (p = 0.231), (5) neonates are born with maternal risk factors such as hypertension (p = 0.98), hypothyroidism (p = 0.29), gestational diabetes mellitus (p = 0.10), PROM (P = 0.099). Of the 200 neonates, 43 (87.8%) with IVH were successfully discharged and six (12.2%) died.

Table Comparison of demographic characteristics, interventions and morbidity of neonates with IVH and without IVH (N = 200)

Gender	Frequency (%) (n=200)	IVH (n=49)	NO IVH (n=151)	P-value
Male	98 (49%)	23 (47%)	75 (49.7%)	0.73
female	102 (51%)	26 (53%)	76 (50.3%)	
MOD				
Vaginal	52 (26%)	40 (81.6%)	12 (8%)	0.001
LSCS	148 (74%)	9 (18.4%)	139 (92%)	
Birth Asphyxia				
Yes	43 (21.5%)	30 (61.2%)	13 (8.6%)	0.001
No	157 (87%)	19 (38.8%)	138 (91.4%)	
Acidosis				
Yes	28 (24%)	12 (24.5%)	16 (10.6%)	0.014
No	172 (86%)	37 (75.5%)	135 (89.4%)	
Apnea				
Yes	84 (42%)	27 (55%)	57 (37.7%)	0.032
No	116 (58%)	22 (45%)	94 (62.3%)	
RDS				
Yes	146 (73%)	39 (79.6%)	107 (91%)	0.231

No	54 (27%)	10 (20.4%)	44 (29%)	
PDA				
Yes	14 (7%)	6 (12.2%)	8 (53%)	0.097
No	186 (93%)	43 (87.8%)	143 (94.7%)	
Hypotension				
Yes	112 (56%)	29 (59%)	83 (55%)	0.605
No	88 (44%)	20 (41%)	68 (45%)	
Seizure				
Yes	61 (30.5%)	12 (24.5%)	49 (32.5%)	0.29
No	139 (69.5%)	37 (75.5%)	102 (67.5%)	
Maternal risk factors				
Hypertension				
Yes	41 (20.5%)	10 (20.4%)	31 (20.5%)	0.98
No	159 (79.5%)	39 (79.6%)	120 (79.5%)	
GDM				
Yes	34 (17%)	12 (24.5%)	22 (14.6%)	0.108
No	166 (83%)	37 (75.5%)	129 (85.4%)	
Hypothyroidism				
Yes	25 (12.5%)	4 (8.2%)	21 (14%)	0.290
No	175 (87.5%)	45 (91.8%)	130 (86%)	
PROM				
Yes	26 (13%)	3 (6%)	23 (15.2%)	0.099
No	174 (87%)	46 (94%)	128 (84.8%)	
Outcome				
Discharge	162 (81%)	43 (87.8%)	119 (78.8%)	0.165
Death	38 (19%)	6 (12.2%)	32 (21.2%)	

DISCUSSION

A total of 200 neonates born before 34 weeks of gestation, admitted in our NICU, between august 2020 to august 2021, who fulfilled inclusion criteria were taken as study subject. Data regarding antenatal and postnatal history and relevant investigation were collected retrospectively.

In our study the incidence of IVH in babies born before 34 weeks of pregnancy was 24.5% (49 out of 200). Findings in our study were consistent with those in studies conducted by Lee JY *et al.*,² Glass HC *et al.*,⁴ where the incidence was between 20-50%. The incidence of IVH grade III-IV severity was lower in my study of 0.05% compared to studies conducted by Robert JC *et al.*,⁵ Poryo M *et al.*,⁶ where the incidence was as high as 20-30%.

There was a statistically significant correlation between gestational age and birth weight in our study that was consistent with other studies conducted by Itsiakos G *et al.*,⁷ Shariat M *et al.*,⁸ and Poryo *et al.*,⁶

We have found lower incidence of IVH when a baby is delivered through a Caesarean section compared to a vaginal delivery, the findings similar to a study conducted by parvo *et al.*,⁶ Even if LSCS is associated with lower incidence of IVH, it is a surgically invasive procedure with its own benefits and loss and should not be recommended without other indication.⁹ We found that congenital asphyxia increases the risk of IVH. Congenital asphyxia is associated with abnormal gas exchange leading to oxygen deficiency and hypercapnea. In a study conducted by Antoniuk S *et al.*,¹⁰ Of 1122 infants born before 37 weeks of gestation, congenital asphyxia was cited as one of the major causes of IVH. Even small changes in the supply of oxygen to the brain increase the risk of bleeding from the central nervous system. Despite the appropriate oxygen saturation, regional oxygenation may be impaired, which significantly increased the risk of IVH in the preterm infants by Bolisetty S *et al.*,¹¹

Male sex is a risk factor for IVH. Factors contributing to these findings may be hormonal, physiological, genetic, and molecular modification. Sex can influence the pathogenesis of brain damage. In addition, sex studies as a risk factor for IVH

are less common than investigations of other known factors^{12,13}. This can be described as irreversible and is therefore of little clinical interest in preventive strategies. In our study there is no significant relationship of children with the risk of IVH.

Low hematocrit anemia is associated with high IVH levels, the findings of which are consistent with previous studies by Khalessi N *et al.*,¹² and salafia *et al.*,¹⁴, it is difficult to determine whether low hematocrit levels have contributed to IVH formation or have been the result of actual bleeding. Bleeding in the brain in the event of IVH in a premature baby is enough to cause anemia in neonates.

In our study, the cutting point for acidosis was set to a pH below 7.2 and / or base deficit below -10. For therapeutic use sodium bi carbonate. As shown in our analysis, acidosis increased the risk of IVH in preterm neonates born before 34 weeks. Regarding the negative internal effect of acidosis on IVH, many studies take a coherent view. A study by Peng Tan A *et al.*,¹⁶ in a group of 3979 patients with VLBW, which focused on the effects of acidosis in premature babies, showed an increased risk of severe IVH and higher mortality rates and higher rates of neurodevelopmental disability. Studies by Robert JC *et al.*, have also linked acidosis to other risk factors that affect the hemodynamic processes and thus contribute to the pathogenesis of IVH. In a study by Coskun Y *et al.*,¹⁷ in a group of 87 preterm infants with a birth weight <1500gm.

In our study, we did not find a significant association between the risk of IVH and PDA. Multivariate analysis showed that PDA was a risk factor for severe IVH in premature babies, which is consistent with many studies. Prophylactic treatment of PDA with indomethacin on the first day of life in preterm infants can reduce the incidence of IVH by increasing liver failure and preventing lung bleeding.^{18,19}

CONCLUSION

Lower gestational age and birth weight, vaginal delivery, perinatal asphyxia, acidosis and anemia are the main causes of IVH. Since no comprehensive treatment for IVH is available, identifying the risk factors is important in developing IVH prevention strategies.

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