

Evaluation of Factors Affecting Intraventricular Hemorrhage in Term Neonates in Tehran Vali-e-Asr Hospital, 2016-2018

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Abstract- Intraventricular hemorrhage can be associated with various complications that ultimately lead to brain damage. This study aimed to investigate the factors affecting intraventricular hemorrhage in term neonates. This case-control study compared 58 full-term neonates with an IVH diagnosis and 100 healthy full-term neonates. Information on exposure to maternal and prenatal risk factors was collected from Vali-e-Asr Hospital's neonatal information system between 2016 and 2018. Data were collected and analyzed in SPSS software. In this study, risk factors significantly associated with IVH included male gender, respiratory distress, pneumothorax, hydrocephalus, thrombocytopenia, anemia, vitamin K deficiency, asphyxia, hypoglycemia, the need for resuscitation at birth, the requirement for mechanical ventilation, and low weight for gestational age. The mean Apgar score of the first and fifth minutes was significantly lower in the IVH group. The results of this study will determine the risk factors affecting intraventricular hemorrhage to predict and manage brain injury in term neonates.

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Introduction

Intraventricular hemorrhage (IVH) in neonates is typically defined as bleeding in the lateral and third or fourth ventricles, characterized by hyperattenuating fluid that is often seen as layering within the ventricles on imaging studies. This complication mainly occurs within the first 72 hours after birth, with approximately half of the cases occurring on the first day of delivery. And in more than 90% of cases, it appears by the end of the first week of life. Intraventricular hemorrhage is a common form of intracranial hemorrhage in neonates, particularly in extremely preterm infants with low birth weight. But some studies have reported the evidence of IVH in about 3.5% to 5.0% of term neonates. This discrepancy can be attributed to the greater maturity of the brain at term and a lower rate of underlying risk factors that predispose to bleeding, such as coagulation disorders.

Although the primary source and etiology of IVH in about half of the term neonates remained unknown,

maternal risk factors such as preeclampsia, urogenital tract infections, chorioamnionitis, and some neonatal risks, including asphyxia, trauma, vitamin K deficiency, thrombocytopenia, and sinovenous thrombotic events, play a significant role in the appearance of this event. The primary source of IVH in term infants is the choroid plexus, thalamus, and germinal matrix, a vascular area prone to bleeding.

Intraventricular hemorrhage can also cause adverse events such as long-term disability, cerebral palsy, mental retardation, seizures, behavioral and cognitive impairments, and death in patients.

Determining the risk factors for this disease can make it possible to think of appropriate measures to prevent brain damage in term infants. Therefore, this study aimed to investigate the factors affecting intraventricular hemorrhage in term neonates during 2016-18 in Vali-e-Asr Hospital in Tehran.

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Materials and Methods

This case-control study, conducted between 2016 and 2018 for three years, involved 158 full-term neonates born in Vali-e-Asr Hospital's labor ward to determine the causes and factors affecting intraventricular hemorrhage in term neonates whose information was registered in the neonatal information system of Vali-e-Asr Hospital (Ethic code: IR.TUMS.IKHC.REC.1397.229).

The case group consisted of 58 full-term infants born during the study period at Vali-e-Asr Hospital, with IVH confirmed by imaging findings (brain ultrasound). One hundred infants who were also held in the same hospital at the same time and were healthy or hospitalized for the treatment of physiological jaundice without an underlying cause and specific disease were included in the control group. The control group had no history of head trauma, syndromic disease, systemic disease, or infection. If there were other brain diseases as well as brain abnormalities in each group, the infant would be excluded from the study. Information on exposure to risk factors such as asphyxia, trauma, bleeding disorders, type of delivery, maternal pregnancy complications (preeclampsia, gestational diabetes, placental abruption), infant weight, plaque level, first and fifth minute Apgar scores, need for resuscitation, Infant sex, Congenital coagulation disorders, and all demographic information and possible factors including age, sex, clinical signs, underlying diseases in the infant, history of comorbidities (brain and non-brain diseases and lesions), laboratory test results and ultrasound in both The case and control groups were collected from the neonatal information registration system of Vali-e-Asr Hospital. Data were collected in SPSS-23 software. The Chi-square, Mann-Whitney, Multivariate logistic regression, and Fisher's exact test were used to compare risk factors in the two groups.

Results

A total of 158 full-term infants admitted to Vali-e-Asr Hospital were examined. The birth weight ranged from 1600 g to 5250 g, and the average birth weight was 3622.2 ± 3069.9 g. The mean height and head circumference of the neonates were 49.8 ± 3.6 and 34.2 ± 1.9 cm, respectively. Fifty-eight of the infants in the study had IVH.

Out of 58 infants with IVH (case group), 12 infants (20.7%) were girls, and 46 infants (79.3%) were boys. In the control group, comprising 100 infants, 51 infants

(51%) were girls, and 49 infants (49%) were boys. The Chi-square test showed that IVH was significantly higher in boys ($P < 0.0001$).

Using chi-square test, significantly in group IVH, respiratory distress syndrome ($P < 0.0001$), pneumothorax ($P < 0.0001$), thrombocytopenia ($P < 0.0001$), anemia ($P < 0.0001$), Need for resuscitation at birth ($P < 0.0001$), need for mechanical ventilation ($P < 0.0001$), need for transfer ($P < 0.0001$), vitamin K deficiency ($P = 0.008$), asphyxia ($P = 0.02$), hypomagnesemia ($P = 0.003$), hydrocephalus ($P = 0.022$), low weight for gestational age ($P = 0.04$) and death ($P < 0.0001$) was greater.

Regarding the type of delivery, 77.6% of the mothers in the case group and 84% of the mothers in the control group had a cesarean delivery, while 22.4% of the mothers in the case group and 16% of the mothers in the control group had a vaginal delivery. The Chi-square test showed that the type of delivery was not related to IVH ($P = 0.315$).

Chronic hypertension, gestational hypertension, chronic diabetes, gestational diabetes, hypothyroidism, acute renal failure, necrotizing enteritis, hereditary metabolic disorder, and neutropenia are not significantly associated with IVH.

No neonatal had hypoxic-ischemic encephalopathy, kernicterus, hypotension, polycythemia, fetal erythroblastosis, Fractures of the humerus, femur, and ribs, vocal cord paralysis, KLUMPKE paralysis, diaphragmatic paralysis, cutting paralysis during childbirth, Hypercalcemia, hypermagnesemia, Hypokalemia, Hyperkalemia, Hyponatremia.

Using the Mann-Whitney test, the first-minute Apgar score and the fifth-minute Apgar score were lower in the IVH group ($P < 0.0001$).

Multivariate logistic regression analysis showed that among the influential factors with intraventricular hemorrhage using the Forward Stepwise method, the male sex and the Apgar score at the fifth minute, the risk of intraventricular hemorrhage increased.

Discussion

This study evaluated the factors affecting intraventricular hemorrhage in term IVH infants born in Vali-e-Asr Hospital in Tehran in 2016-18 (Table 1). The results of the analysis showed that in group IVH, respiratory distress syndrome ($P < 0.0001$), pneumothorax ($P < 0.0001$), thrombocytopenia ($P < 0.0001$), anemia ($P < 0.0001$), need for resuscitation At birth ($P < 0.0001$), need for mechanical ventilation

($P<0.0001$), need for transmission ($P<0.0001$), vitamin K deficiency ($P=0.008$), asphyxia ($P=0.02$), Hypomagnesemia ($P=0.003$), hydrocephalus ($P=0.022$), low weight for gestational age ($P=0.04$) and death

($P<0.0001$) were significantly more. In this study, male sex and fifth-minute Apgar scores were identified as significant risk factors for IVH (Table 2).

Table 1. Table of the frequency distribution of factors affecting IVH

Group\ IVH factors	Case Group		Control Group	
	Frequency	Percent	Frequency	Percent
Respiratory Distress Syndrome	8	13.8	•	•
Pneumothorax	10	17.2	•	•
Hydrocephalus	3	5.2	•	•
Thrombocytopenia	13	22.4	•	•
Anemia	7	12.1	•	•
Need for resuscitation at birth	24	41.4	•	•
Requires mechanical ventilation	16	27.6	•	•
Vitamin K deficiency	4	6.9	•	•
Asphyxia	3	5.2	•	•
Hypomagnesemia	5	8.6	•	•
Small for gestational age	18	31	17	17

Table 2. Comparison of the means of quantitative variables between the two groups

Group\ Variables	Case group (Mean±SD)	Control group (Mean±SD)	<i>P</i>
Height(cm)	49.14±3.64	50.29±2.491	0.133
Head circumference (cm)	34.08±2.54	34.34±1.424	0.839
Weight (g)	2997.33±638.07	3112.00±511.83	0.501
Apgar first minute	6.58±2.82	8.73±0.62	0.0001
Apgar fifth minute	8.25±1.94	9.48±0.65	0.0001

All the studies reviewed, according to the subject of our research, are within the age range of the infant, which can help us compare the information obtained from our research. In the studies, the etiologies related to IVH have been examined.

Balraj *et al.*, (1) identified thrombocytopenia as the most essential cause of IVH. In our study, 8.2% of patients had thrombocytopenia, which can have multiple

causes, including sepsis. Balraj *et al.*, (1) also found instrumental delivery, low 1st and 5th minute Apgar scores, and the need for resuscitation to be associated with cerebral hemorrhage. In this study, the need for resuscitation and lower Apgar scores in the first and fifth minutes were identified as factors influencing IVH (Table 3).

Table 3. Multivariate analysis of factors affecting intraventricular hemorrhage

Variable	<i>P</i>	Adjusted OR (95% CI)
Gender	0.012	4.623 (1.401-15.26)
Apgar fifth minute (Scores)	0.005	5.158 (1.658-16.04)
Temporary neonatal thrombocytopenia	0.998	4.623 (0.00-48.02)
Need for Resuscitation	0.997	2.823 (0.00-22.74)

In a study by Lara *et al.*, (2), a link was found between IVH and patient problems, which may have been due to ventilation disorders, temperature disturbances, and the ambulance environment. The results of this study were similar to those of Spasojević

et al., (3).

In our study, asphyxia was significantly more common in infants with IVH. Lackmann *et al.*, (4) also stated that asphyxia is an influential factor in the incidence of IVH.

In a study by Valentina *et al.*, (5), it was found that male infants were more at risk for intracerebral hemorrhage than female infants and were more likely to have more severe IVH in this sex. But to a lesser degree, the two sexes were no different.

In this study, the IVH group was more likely to need resuscitation, asphyxia, and mechanical ventilation. David *et al.*, (6) also identified asphyxia and the need for infant resuscitation as causes of IVH. The need for mechanical ventilation has been more significant in these infants, who also say that natural childbirth is a traumatic process and can lead to IVH. Of course, further studies are needed to confirm this. This statement was also consistent with the research of Khan *et al.*, (7).

In the present study, factors such as asphyxia, thrombocytopenia, and hypotension were seen more in infants with IVH, which is consistent with other existing studies (8).

In the study by Tavit *et al.*, (9), the average Apgar score in the first minute was 7; however, in our study, it is 7.91, which is slightly higher. This may be due to differences in the statistical population. In our study, the Apgar scores of all infants were examined. But in the above analysis, all patients had IVH.

In the study by Jong *et al.*, (10), as in various other studies, it has been stated that the occurrence of IVH can cause irreparable damage to the child. This highlights the importance of identifying and treating these children, which underscores the significance of our study and other similar studies. Perhaps the advantage of our research lies in the study of other risk factors, allowing for the identification and treatment of groups most at risk to occur more quickly (11,12).

The results of this study will identify the risk factors affecting intraventricular hemorrhage, enabling the prediction and management of brain damage in term infants. Therefore, by recognizing the risk factors for IVH and reducing these risk factors, the likelihood of this neonatal severe complication can be reduced.

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