



# Evaluation of Intraventricular Hemorrhage in Very Low Birth Weight and Premature Infants

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**Abstract:** *Introduction: Intraventricular hemorrhage (IVH) is one of the major causes of neonatal inability and death. Due to the higher incidence of IVH in very low birth weight and preterm infants, this study aimed to determine the prevalence of Intraventricular hemorrhage in very low birth weight and premature infants admitted to the Persian Gulf Hospital. Method: This study was conducted on 350 infants with very low birth weight and prematurity admitted to the Persian Gulf Hospital from March 2017 to May 2018. Sex, gestational age, weight, maternal morbidity, familial history, complications and grade of intraventricular hemorrhage were investigated. T-test and Chi-square were used for data analysis. Results: The prevalence of intraventricular hemorrhage was 9.4% in newborns. The average weight and age of pregnancy in IVH neonates were significantly lower than those without IVH and the frequency of female subjects was significantly higher in neonates with intraventricular hemorrhage than other neonates, and other factors were not related to the neonatal disease. Conclusion: Considering the high prevalence of IVH in low birth weight infants and the identification of risk factors in this study (low birth weight, low gestational age, and female gender) and, on the other hand, mortality and morbidity of newborns with low birth weight, especially newborns with ventricular hemorrhage, routine skull ultrasonography is recommended for timely screening and risk factor modification.*

**Keywords:** *Intraventricular Hemorrhage, Prematurity, Very Low Birth Weight.*

## INTRODUCTION

Intracerebral hemorrhage during a neonatal period is an important clinical problem. It is associated with a relatively high prevalence, especially in premature infants, which is associated with severe neurological complications and mortality (Volpe, 2001). Intraventricular bleeding (IVH) can occur after the germinal matrix bleeding and its complications are hydrocephalus (Swaiman et al., 2006). Changes in cerebrospinal fluid flow, decreased or increased pressure cerebrospinal fluid, coagulation disorders, infection and the absence of protective mechanisms in the cerebrovascular are involved in the incidence of IVH (Volpe, 2001). Following the bleeding and destruction of the germinal matrix, there are cysts in this area that are recognizable in ultrasound (Nelson Waldo et al., 2004). In the ultrasound of the skull, intraventricular hemorrhage is classified in degrees 1 through 4 according to size (Volpe, 2001). Intraventricular hemorrhages of Grade 1 and 2 do not increase the incapacity of the newborn, but Grade 3 and 4 can cause spastic hemiplegia and learning disorder (Ward, Beachy, 2003). Most bleeding in preterm infants is less than 32 weeks of gestation and less than 1500 grams, on the

first day and 90% of bleeding occurs in the first 4 days; hence, screening ultrasound is recommended on days 7 and 14 after birth and in the case of normal, repeated ultrasonography at the time of term (40-36 weeks) (Vollmer et al., 2003; Kadri et al., 2006; Nwafor-Anene et al., 2003). Considering the importance of cerebrovascular bleeding in infants and the lack of a study in the Persian Gulf Hospital of Bandar Abbas as a referral center for obstetrics and gynecology in Hormozgan province during the study period, we conducted this study to evaluate the incidence of cerebrovascular bleeding in very low birth weight infants admitted to the Persian Gulf Hospital.

## Methods

In this study, all infants who were born in the Persian Gulf Hospital in Bandar Abbas from March 2017 to May 2018 with a diagnosis of prematurity and very low birth weight, including 350 infants were included in the study. Infants were admitted to the NICU and the neonatal department of the hospital. After confirmation by the Ethics Research Committee and the Persian Gulf Hospital, the parents were informed and the babies were selected in the hospital. First, we asked their mothers a complete history of the relationship between the demographic data of their infants and their mothers, the age of birth of the fetus, maternal diseases, birth weight, etc. The baby was then sent to ultrasound for IVH review. Data were extracted from the ultrasound and entered the checklist. In the following, all of the above information was entered into the SPSS Statistical Analysis Program Version 18 and we analyzed the data.

All patients' data including demographic factors and paraclinical symptoms were recorded in the checklist by the administrator and entered into SPSS 18. Statistical analyses were presented in two sections: descriptive and analytical. In the descriptive part, the prevalence of IVH as a major variable in different groups was presented and all clinical and demographic information of patients were also reported based on descriptive criteria. In the analytical section, parametric and non-parametric tests, proportional tests were used based on statistical assumptions. Chi-square test was used to analyze the qualitative findings and independent T-test was used for comparing quantitative data. In the absence of basic assumptions like normal, the Mann-Whitney non-parametric test was used. All tests were examined at a 5% error level.

## Results

In this study, 350 infants with very low birth weight were enrolled, of whom 33 (9.4%) had an intracranial hemorrhage.

The results of this study are presented in the following tables.

**Table 1:** Frequency of studied variables in neonates with intracerebral hemorrhage

Variable	Sub variable	Quantity	Percentage
Sex	Boy	10	30.3
	girl	23	69.7
Gestational Age	Less than 30 weeks	21	63.6
	More than 30 weeks	12	36.4
Weight	1000 grams and less	14	42.4
	More than 1000 grams	19	57.6
Coagulation disorder	No	31	93.9
	Yes	2	6.1
Mother`s disease	No	26	78.8
	Gestational Diabetes	3	9.1
	Eclampsia	2	6.1
	Preeclampsia	2	6.1
Family history	No	32	97.0
	Yes	1	3.0
Complications	No	27	81.8

	Yes	6	18.2
Grade	I	19	57.6
	II	8	24.2
	III	5	15.2
	IV	1	3.0

**Table 2:** Mean and standard deviation of weight and gestational age based on the incidence of IVH

Variable	Group	Quantity	Average	Standard Deviation	P-value
Weight (Grams)	Without IVH	317	1308.14	145.97	0.004
	With IVH	33	1146.72	197.29	
Gestational Age (weeks)	Without IVH	317	30.58	2.01	<0.001
	With IVH	33	29.69	2.17	

**Table 3:** Frequency of gender in neonates based on the incidence of IVH

Sex \ Group		Without IVH	With IVH	All	P-value
Boy	Quantity	174	10	184	0.007
	Percentage	54.9	30.3	52.6	
Girl	Quantity	166	23	143	
	Percentage	47.4	69.7	45.1	

According to our study, 69.7% of infants with intraventricular hemorrhages were girl, 63.6% had a gestational age less than 30 weeks, 42.4% had a weight less than 1,000 grams, 9.1% had gestational diabetes, 6.1% had eclampsia and 6.1% had preeclampsia, 3% had a positive family history, 18.2% had complications, 57.6% had grade 1 and 24.2% had grade 2, 15.2% had grade 3 and 3% had grade 4 (Table 1).

The gestational age in infants with intracranial hemorrhage was 29.69 weeks and the average weight was 1146.72 g; the average weight in IVH neonates was significantly lower than those without IVH (P=0.004). Also, the average age of pregnancy was significantly lower in neonates with IVH than in non-IVH infants (P<0.001) (Table 2).

The frequency of female sex in IVH was significantly higher than that of other infants (P=0.007) (Table 3), the frequency of history of intraventricular hemorrhage (P=0.18) and the frequency of mother's illness (P=0.502). There was no significant difference in the incidence of IVH in newborns.

### Discussion

The present study was conducted to investigate the incidence of cerebrovascular hemorrhage in very low birth weight and premature infants admitted to the Persian Gulf Hospital from March 2017 to May 2018. In this study, 350 infants with very low birth weight were enrolled in the study, of whom 33 (9.4%) had an intracranial hemorrhage. On the other hand, it was found that the average weight and average gestational age of newborns with IVH was significantly lower than those without IVH. Also, the frequency of female subjects was significantly higher in neonates with IVH than in other infants. However, the frequency of history of intraventricular hemorrhage and the frequency of maternal disease did not correlate with the disease of the neonatal.

In a study by Abdi et al., 200 neonates were evaluated and the percentage of IVH in the neonates was 28% with a 95% confidence interval (25.2% to 30.9%). The most common type of IVH was grade I bleeding (37.5%) and the lowest grade IV bleeding (3.7%) (Abdi et al., 2003). The results of this study on the prevalence of IVH are 3 times higher than ours. On the other hand, the prevalence of Grade I in this study is half of our study. However, with regard to the prevalence of Grade IV, this is similar to our study. The reason for the differences is the difference in the sample size of the study, difference in demographic characteristics of individuals, difference in entry and exit criteria and the difference in how data are sampled.

A study was conducted by Nafisi Moghaddam et al. on a total of 52 neonates (86.67%) of the samples, neonates with birth weights were less than 2500 g (LBW). Of the 52 patients with LBW, five infants (9.6%) had IVH and five children (9.6%) had hydrocephalus, and one newborn (1.9%) had Holoprosencephaly disease, and eight had normal weight. There was no abnormal finding in ultrasound (Nafisi Moghaddam et al., 2010). The results for IVH are in line with the findings of our study.

A study by McCrea HJ et al. showed that 20-25% of preterm infants and VLBW had IVH. Infants who have IVH are at risk of developing hydrocephalus after hemorrhagic and periventricular leukomalacia. Approximately, 75% of patients who find parenchymal involvement find parenchymal hemorrhage with neurodegenerative disorders (McCrea, Ment, 2008). In our study, it was found that nearly 20% of infants who had IVH had complications including the occurrence of hydrocephalus.

A study was conducted by Szpecht D et al. to evaluate the prevalence of IVH in neonates with a birth weight of fewer than 32 weeks. The results showed that the incidence of IVH with stages 3 and 4 was observed in 25% of infants. The most common incidence of IVH occurred in the 25-26-week gestational age (Szpecht et al., 2016). Regarding the outbreak in our study, it was found that the prevalence of Grades 3 and 4 was 18.2%, which was slightly lower than the study, and the reason for the incidence of IVH was related to low birth weight, low gestational age, and female gender.

In the study of Lee JY et al., it was found that out of 1044 neonates, 59 neonates with IVH had a 2-3-4 stage (Lee et al., 2010). In our study, it was found that the incidence of IVH grade 2-3-4 is 42.2% of all IVH cases, and out of a total of 350 neonates, 4% of the total number of neonates and 5.6% in the study similar to our study.

In the study of Samaei et al., from 84 neonates, 28 (33%) patients had intraventricular hemorrhage; This bleeding was observed in infants weighing less than 1000 g, 50% and weighing from 1000 to 1500 g, 41% and in preterm infants weighing more than 1500 g, 22%. In infants with gestational age, less than 29 weeks 56% and in group 30 to 34 weeks of gestational age 32% had an intraventricular hemorrhage (Samaei, 1999). The results of this study on the higher prevalence of intraventricular hemorrhage in low birth weight and gestational age neonates are consistent with our findings, but the percentages obtained are significantly higher than our study.

In the study of Badiei, 167 neonates were studied. The relative frequency of IVH in neonates less than 35 weeks was 19.5% and in infants weighing less than 1500 g, 25%. Relative frequency of IVH had a significant relationship with gestational age and low birth weight. Of the 167 infants, 9 (5.3%) IVH grade 1, 14 (8.3%) IVH grade 2, 9 (5.3%) IVH grade 3 and 1 person (0.5%) IVH grade 4 had (Badiei, 2006). The results of this study regarding the higher prevalence of IVH in low birth weight and gestational age neonates are consistent with our findings. However, the percentages obtained in different grades of IVH are completely different from the results of our study, especially in Grade One, which in our study was about 60% of subjects with Grade One, but in this study, Grade Two had the highest frequency. The reason for the difference is due to the difference in the sample size of the study, difference in demographic information of individuals, difference in the inclusion and exclusion criteria and the difference is in how data are sampled.

In the study of Asadi et al., a total of 3648 neonates were admitted, of whom 1164 (31.9%) preterm infants and 43 (3.7%) had an intraventricular hemorrhage (case group). The average gestational age was  $28.1 \pm 2.1$  years and the average birth weight was  $1136 \pm 340.8$ . The average birth weight and gestational age were significantly higher than the case group (Asadi, 2010). The results of this study on the neonatal characteristics of IVH are consistent with our findings.

## Conclusion

The results of this study showed that IVH had a direct and significant relationship with low birth weight, low gestational age and female sex. Therefore, in view of the high prevalence of IVH in low birth weight infants and the identification of risk factors in this study (low birth weight, low gestational age and female sex) and on the other hand, due to the deaths and complications of low birth weight infants, especially newborns with ventricular hemorrhage, root cranial ultrasound is recommended for timely screening and adjustment of risk factors.

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