

Incidence and Severity of Intra-Ventricular Haemorrhage (IVH) in Preterm Infants, Northeast of Iran

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Abstract

Introduction: The incidence rate of Intra-Ventricular Haemorrhage (IVH) varies from 20% to 25% among preterm infants with a very low birth weight. IVH could compose critical disabilities which are directly associated to its grade. The aim of this study was to evaluate the incidence and severity of IVH in preterm infants referred to the academic Hospital of Gorgan, Northeast of Iran. **Materials and Methods:** In this cross-sectional study, we examined all preterm infants who had been referred to the academic Hospital of Gorgan, Northeast of Iran between Augusts 2014 and February 2015. Seventy one preterm infants (≤ 34 weeks of gestation, ≤ 1500 g birth weight) have been included. Cranial ultrasound was done within 3-5 days of birth for all subjects and subsequent ultrasounds were performed based on their birth weight by portable ultrasound device. **Results:** The overall incidence of IVH was 64.8% in the present study. There was a significant relationship between IVH incidence and the gestational age ($p=0.010$). Also the lower birth weight was associated to the higher rate of IVH complications reported in sequential ultrasounds ($p<0.05$). **Conclusion:** Gestational age and birth weight seem to have key roles in the occurrence and severity of IVH, respectively.

Key words: Intra-ventricular haemorrhage; ultrasound; preterm infants; low birth weight

Introduction

The incidence rate of Intra Ventricular Haemorrhage (IVH) has been reported 20% to 25% among preterm infants with an extremely low birth weight and 45% in those weighing 500-750 gm¹, and remains as a major complication of preterm labour resulting in certain critical disabilities^{2,3}. Those infants with a gestational age less than 28 weeks are more susceptible to IVH, and those who survive will show signals of neuro-developmental failures and long-term disabilities^{4,5}.

Periventricular germinal matrix is the onset location of the IVH where the neuronal precursor cells and glial are accumulated⁶. In preterm infants, this region is vulnerable to haemorrhage mainly in the first 48 hours of life. If the haemorrhage in the germinal matrix is

outstanding, the ependyma may break and thus, blood will fill the cerebral ventricle. IVH is considered to be result of a developing germinal matrix haemorrhage⁷. Cranial ultrasound is performed to reach the most accurate diagnosis in these infants and also as a screening process in asymptomatic ones¹.

The survival rate of preterm infants is decreased mainly due to increased risk of neurological disorders. The mortality rate of neonates with severe IVH is noticeably higher than those without IVH⁸. The IVH presentations are directly associated with the IVH grades; moderate-to-severe IVH (grade 3–4) exposes infants to a high risk of cerebral palsy, post-haemorrhagic hydrocephalus, mental retardation and peri-ventricular leukomalacia; while infants with mild IVH (grade 1–2) can be at the risk of certain developmental disabilities^{9,10,11}.

There are some associations between the occurrence of IVH and series of prenatal and postnatal events¹².

The aim of this study was to evaluate the incidence and severity of Intra-Ventricular Haemorrhage (IVH) in preterm infants in Gorgan, Northeast of Iran.

Material and Methods

This was a cross-sectional study where we examined all preterm infants who had been referred to Sayyad Shirazi Hospital of Gorgan, during August 2012 to February 2013. Seventy one preterm infants (≤ 34 weeks, $1500 \text{ gm} \leq \text{birth weight}$) have been included considering the following inclusion criteria:

1. Gestational age ≤ 34 weeks and birth weight $\leq 1500 \text{ gm}$,
2. All born at the same hospital and
3. Being available for follow-up until the end of the 40th week post conception age.

Mother and infant underlying data were recorded in a checklist including: mother age, medical history, drug history, infant 1st and 5th second APGAR, birth weight and gestational age. We performed cranial ultrasound using portable ultrasound device (Hyundai 2000) during the first week of birth (3-5 days after birth) in all infants and subsequent ultrasounds have been performed in accordance to their birth weight as followings¹³:

- a. Birth weight $\leq 1000 \text{ gm}$: the first ultrasound was performed at day 3-5; the second one at day 10-14 and the third one was conducted on the 28th day after birth. The final ultrasound was done before the hospital discharge to diagnose the late onset lesions.

- b. Birth weight $1000 \text{ gm} - 1250 \text{ gm}$: first ultrasound was performed at day 3 to 5, the second on the 28th day and the third was performed before discharge to diagnose the late onset lesions.
- c. Birth weight $1250 \text{ gm} - 1500 \text{ gm}$: first ultrasound was performed at day 3 to 5 and the second before discharge.
- d. If higher degrees of IVH had been reported, next ultrasound would have to be performed according to the protocol.
- e. All dead infants underwent ultrasound examination of IVH.

We divided the severity of haemorrhage into four major categories based on the bleeding situation and intensity of ventricular dilatation in the ultrasound¹⁴.

Grade I: Haemorrhage was restricted to germinal of matrix or less than 10% of ventricle.

Grade II: Intra-ventricular haemorrhage filled 10% - 50% of ventricle without ventricular dilatation.

Grade III: Over 50% involvement of ventricle with acute ventricular dilatation

Grade IV: Ventricular involvement with or without dilatation accompanied by intra-parenchymal haemorrhage.

The last cranial ultrasound of the dead infants was conducted within 24 hours after the occurrence. To investigate late onset complications, ultrasound was followed up for 40 weeks of the modified gestational age.

Data Analysis was done by using the Chi-square test, logistic regression, and correlation tests were applied. The significance level was considered 0.05.

After approval of the Ethics Committee of Golestan University of Medical Sciences, we explained the importance of the project to the parents and informed consent was taken.

Results

The overall incidence of IVH was 64.8% in the present study. There was a significant relation between IVH incidence and the gestational age ($p=0.010$) but the severity of IVH and the gestational age were not significantly related ($p=0.255$).

Pearson Chi-Square clarified a significant association between the IVH grade and its complications and the low birth weight ($p=0.046$).

Table 1: Showing severity of IVH within days 3-7, 10-14, 28, discharge time, and 40th weeks of the modified gestational age and after death

Grade of IVH	Time of the Ultrasound examination(days)					
	3-7	10-14	28	Discharge	40 weeks of modified gestational age	After death
No IVH	31 (45.6%)	7 (24.1%)	12 (35.3%)	38 (73.1%)	53 (94.64%)	-
Grade 1	17 (25%)	11 (37.9%)	11 (32.4%)	9 (17.3%)	3 (5.36%)	1 (7.1%)
Grade 2	11 (16.2%)	3 (10.3%)	3 (8.8%)	2 (3.8%)	-	1 (7.1%)
Grade 3	4 (5.9%)	4 (13.8%)	7 (20.6%)	2 (3.8%)	-	2 (14.3%)
Grade 4	5 (7.4%)	4 (13.8%)	1 (2.9%)	1 (1.9%)	-	10 (71.4%)
Total	68 (95.8%)	29 (40.8%)	34 (47.9%)	52 (73.2%)	56 (78.9%)	14 (19.7%)

There were no complications of IVH in 60 (88.2%) patients.

Within days 3-7 and day 28 after birth, and at the discharge ultrasound examination revealed a significant relation between the IVH grade and its complications ($p=0.05$).

Fifteen (21.13%) cases died before the end of the 40th week of the gestational modified age. There was a significant relationship between the gestational age and death rate before 40th weeks of the modified gestational age ($p<0.05$).

Post-mortem ultrasound showed that 100% of the dead cases had abnormal cranial ultrasound.

Discussion

In the present study on 71 preterm infants in Northeast of Iran, we found a significant difference in the IVH incidence regards to the gestational age. Nevertheless, there was no association between the severity of IVH and the gestational age.

Mulindwa *et al.* studied the prevalence of intra-ventricular haemorrhage and the associated risk factors

in preterm neonates and reported grade 1 (mild) IVH as the most frequent condition among preterm infants with a birth weight of 1.5kg¹⁵.

Klebermass-Schrehof *et al.* surveyed the impact of low grade Intra-Ventricular Haemorrhage on long-term neuro-developmental outcomes in preterm infants and reported an increase of abnormal results with a rising grade of IVH¹⁶. This was consistent with our findings. Furthermore, they claimed that the gestational age influences the impact of intra-ventricular haemorrhage on the neuro-developmental outcome¹⁶ which was in accordance with our results.

Chen *et al.* studied the incidence of brain injuries in premature infants with gestational ages ≤ 34 weeks in ten urban hospitals in China. Through basically similar methods, they presumed PVL as the major complication of IVH¹⁷; which is also consistent with our results.

Conclusion

We found that the gestational age plays a key role in the incidence of IVH while there appeared to be no association between IVH severity and the gestational age.

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