

Incidence of Intraventricular Hemorrhage and Post Hemorrhagic Hydrocephalus in Preterm Infants

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Received: 18 Jan. 2009; Received in revised form: 17 Mar. 2009; Accepted: 17 May 2009

Abstract- Germinal matrix-intraventricular hemorrhage (IVH) is the most common variety of neonatal intracranial hemorrhage and is characteristics of the premature infant. The importance of the lesion relates not only to its high incidence but to their attendant complications (IC: hydrocephalus). Brain sonography is the procedure of choice in diagnosis of germinal matrix- intraventricular hemorrhage and hydrocephalus. In this study we have used brain sonography for detection of intraventricular hemorrhage and post hemorrhagic hydrocephalus and their incidences. The studied population was consisted of premature neonate (birth weight equal or less than 1500g and gestational age equal or less than 37 weeks) who admitted in Mofid Hospital NICU (Tehran, Iran) during a one year period. For all neonate (including criteria) brain sonography in first week of life was done and in presence of IVH, serial Brain sonography was done weekly for detection of hydrocephalus. A total of 57 neonate entered the study. Intraventricular-germinal matrix hemorrhage was seen in 64.4% (35 patients). Forty percent of patients with intraventricular-germinal matrix hemorrhage had grade I, 11% grade II, 25.7% grade III, 2.8% grade VI. Hydrocephalus was detected in 20 percent of patients who had intraventricular-germinal matrix hemorrhage. That incidence of IVH in our study in comparison with other area and situation is higher. Hydrocephaly had direct relation with severity of IVH. This shows that with control of risk factor of IVH, we can control Post hemorrhagic hydrocephalus.

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Acta Medica Iranica 2010; 48(4): 260-262.

Key words: Hemorrhage; cerebral ventricles; hydrocephalus; ultrasonography

Introduction

Germinal matrix-intraventricular hemorrhage (IVH) is the most common variety of neonatal intracranial hemorrhage and is characteristics of the premature infant (1). The importance of the lesion relates not only to its high incidence but to their attendant complications (IC: hydrocephalus). The incidence of IVH in premature has decreased in recent years to variable degree in most neonatal center. But due to two reasons, IVH is not a becoming a loss problem. First, the incidence is directly correlated with the degree of prematurity and second, survival rate for the smallest premature infants continue to increase (1). Several studies has been done for investigating the incidence of intraventricular hemorrhage and post hemorrhagic hydrocephalus (2,3).

The site of origin of IVH characteristically is in the subependymal germinal matrix where is the source of

cerebral neuronal precursors between approximately 10 to 20 weeks of gestation.

The many thin-walled vessels in the matrix are a ready source of bleeding. Intravascular, vascular and extravascular factors play important roles in the pathogenesis of IVH. Low birth weight, prematurity, respiratory distress syndrome, and related complications like pneumothorax, use of mechanical Ventilation and asphyxia are the most contributing factors. The two essential steps for detection and management of intraventricular hemorrhage are recognition of at risk neonate and utilization of a suitable screening procedure (1).

Brain sonography is the procedure of choice in diagnosis of germinal matrix- Intraventricular hemorrhage and hydrocephalus (4).

In this study we have used brain sonography for detection of intraventricular hemorrhage and post

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hemorrhagic hydrocephalus and their incidences in our population.

Patients and Methods

We conducted a descriptive prospective study among premature neonate (birth weight equal or less than 1500g and gestational age equal or less than 37 weeks) who admitted in Mofid Hospital NICU (Tehran, Iran) before 14 day old. Patient's demographic data like gestational age, birth weight, disease diagnosis and presence of pneumothorax and respiratory distress were recorded.

For all neonate (including criteria) brain sonography in first week of life and then in second week of life for detection of intraventricular- germinal matrix hemorrhage and it's grading were done and if a neonate has intraventricular hemorrhage, then serial Brain sonography were done weekly for detection of hydrocephalus. Clinical sign of hydrocephalus (sign of increased intracranial pressure) and size of serial head circumference were recorded. Brain sonography was done by TOSHIBA device with 6 MHZ transducer in two sagittal and coronal plans. Hemorrhagic lesions were seen as hyperdense echo area in caudothalamic groove. Depending to amount of blood in lateral ventricle and presence of ventricular dilatation, IVH was graded according to neurology text (1). If lateral ventricular height at body's portion in mid-thalamus area was longer than 10 mm, it was considered as hydrocephalus irrespective to presence or absence of clinical sign of hydrocephalus (5). The data was analyzed using chi- square test, fisher exact test, Mann Whitney test with SPSS 15 and $P < 0.05$ considered statistically significant.

Results

A total of 57 Neonate entered the study. They had a median gestational age of 30 weeks (26-36 weeks and

mean birth weight 1190.45 ± 204.3 g. Table 1 shows the demographic characteristics of all neonates. Respiratory distress and pneumothorax were present in 73.7% and 15.8 of patients respectively. Intraventricular-germinal matrix hemorrhage was seen in 64.4% (35 patients). Forty percent of patients with intraventricular-germinal matrix hemorrhage had grade I, 11% grade II, 25.7% grade III, 2.8% grade VI. Hydrocephalus was detected in 20 percent of patients who had intraventricular-germinal matrix hemorrhage only one patient developed sign of increased intracranial pressure (as inappropriate increase of head circumference). Two patients had rapidly progressive hydrocephalus and five patients had slowly progressive hydrocephalus.

The minimum and maximum birth weight of cases with intraventricular-germinal matrix hemorrhage were 760gr and 1500gr with median value of 1150gr and for those with no intraventricular-germinal matrix hemorrhage was 900gr and 1500gr with median value of 1325gr that had $P = 0.035$. The minimum and maximum and mean gestational age of patients with intraventricular -germinal matrix hemorrhage were 26 week of age, 36wk of age and 29wk of age respectively and for those without intraventricular- germinal matrix hemorrhage were 28wk of age, 34wk of age and 30wk of age that showed P value=0.015 (Table 2).

13.3 percent of patients who had no respiratory distress developed intraventricular-germinal matrix hemorrhage in comparison of 82.5 percent of patients with respiratory distress who developed intraventricular-germinal matrix hemorrhage that had $P = 0.001$.

100 percent of patients with pneumothorax developed intraventricular-germinal matrix hemorrhage and 56.5% of patients without pneumothorax developed intraventricular hemorrhage that showed $P = 0.019$

100 percent of patients with grade I, 77.8% with grade II, and 20 percent with grade III didn't developed hydrocephaly. 100 percent of patients with grade IV IVH, developed hydrocephalus. Relation of severity of hemorrhage with hydrocephalus showed $P = 0.001$

Table 1. Demographic characteristics

Characteristic	Min	Max	Mean	Median
Birth weight (g)	600	1500	1190.45 ± 204	1200
Gestational age (weeks)	26	36	30	

Table 2. Characteristics of patient with and without IVH

Characteristic and percent IVH	Gestational age (weeks)			Birth weight (g)			Total	
	Min	Max	Mean	Min	Max	Median	Number	Percent
IVH	26	36	30	760	1500	1150	35	61.4%
No IVH	28	34	30	900	1500	1325	22	38.6%

Discussion

The IVH is the most common intracranial hemorrhage that especially happens in premature meant.

In our study, the incidence of intraventricular-germinal matrix hemorrhage was 61.4%. This finding shows that IVH in our population can cause significant morbidity and neurologic complications and we must find out the etiology and establish preventive measure.

Rumack *et al.* (4) studied 49 neonates with gestational age of less than 32 wk of age. They mentioned IVH occur in 45 percents of patients. In Antoniuk's and Dasilva (7) study, the incidence of IVH was 36% and respiratory distress, low APGAR, low birth weight were considered as risk factors.

Macini *et al.* (8) have done a study on neonate with birth weight of less than 1500g. They showed that the incidence of intraventricular hemorrhage for neonate with less than 1000g birth weight is 53% and for those with gestational age less than 30 weeks was 47.3%.

These data show that incidence of IVH in our study in comparison with other studies is higher. It seems that this deference may be related to different character of population (like presence of risk factors), and different circumstances and medical care of high risk neonate in NICUs. In our study the neonates were all out born and then transferred for intensive care unit that this explains the presence of multiple risk factors (like respiratory distress, asphyxia, ...) in neonates and transportation is an important risk factor for developing IVH and probably there were some other risk factor at the birth hospital (like mode of resuscitation, perinatal risk factors) that we didn't know them, it seems that intensive care and monitoring of these high risk neonate may be different in deferent NICUs. So this study showed high incidence of IVH in our population and this needs to investigating the etiologies and causes and conducting other studies to find out other possible important risk factors and then establish preventive measure(s) for lowering this complication. The incidence of high grade IVH (grade III, VI) was 28 % in Alvarez and Vilamil's study (9), the incidence of IVH (grade III and VI) was 30 % and in Macini *et al.* (8) study the incidence was 30 percent. Birth weight and gestational age in patients with IVH were statistically lower than those patients without IVH. Respiratory distress and presence of pneumothorax had higher incidence in patients with IVH. In Linder *et al.* study (10), the incidence of IVH had reverse relation with birth weight and gestational age. The incidence of post hemorrhagic hydrocephalus in present study was 20% and only one patient show clinical sign of increased intracranial pressure so serial brain sonography can

show this complication earlier. Dykes *et al.* (11) reported that the incidence of hydrocephaly in 409 neonates with IVH was 13 percent and in Slabaugh *et al.* (12) study the incidence of post hemorrhagic hydrocephalus was 59 percent.

In conclusion, in consistence with other reports our study showed that hydrocephaly had direct relation with severity of IVH. Therefore, by control of risk factors of IVH, we can prevent post hemorrhagic hydrocephalus.

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