ORIGINAL ARTICLE

Significance of Cranial Ultrasound in the Diagnosis of Intraventricular Haemorrhage in Premature Neonates

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ABSTRACT

Aim: To determine the frequency of intraventricular haemorrhage (confirmed by ultrasound) in clinically suspected premature neonates.
Study design: Descriptive study.
Subjects & methodology: The study was conducted at the Department of Radiology, Children Hospital, Institute of Child Health, Lahore from 17-02-2012 to 16-02-2013. A total of 116 premature neonates with maternal gestational age less than 37 weeks, birth weight less than 2.5 Kgs, and of both the sexes were included in this study. Cranial ultrasound was carried out in all neonates using standard coronal and parasagittal images, using 5 M Hz transducer through anterior fontanellae. Staging was performed using the grading suggested by Papil et al. Grade–I haemorrhage is confined to the subependymal matter. Grade–II haemorrhage is an intraventricular haemorrhage without ventricular dilatation. Grade–III haemorrhage is an intraventricular haemorrhage with ventricular dilatation. Grade–IV haemorrhage is intraparenchymal. The baseline threshold set by ultrasound machine to determine IVH more than 5 mm. A water soluble gel (aqua sonic) was used as a coupling agent. The following data was collected about gestational age, birth weight, sex, ultrasound grading and neonatal age (hours).
Results: Out of 116 cases, intraventricular haemorrhage was found in 19 patients (16.4%). Mean gestational age was 32.7±6.7 and 33.1±7.2 weeks with and without IVH, respectively. Most babies developed IVH between 24-48 hours of life i.e. 47.4%. Eleven babies (31.6%) developed IVH in first 24 hours and 2 babies (21.0%) developed IVH after 48 hours of life. Regarding various grades of IVH, out of 19 neonates with IVH, 6 neonates (31.6%), 10 babies (52.6%), 2 babies (10.5%) and 1 baby (5.3%) had grade-I, grade-II, grade-III and grade-IV haemorrhage respectively.
Conclusion: The frequency of intraventricular haemorrhage in clinically suspected premature neonates is high in cases with low gestational age and low birth weight. The ultrasonic grading was directly related to the clinical signs and symptoms of the patients.
Keywords: Intraventricular haemorrhage, premature neonates, Weight less than 2.5 kg

INTRODUCTION

Intraventricular haemorrhage (IVH) is a crucial health issue of preterm birth and large haemorrhages will likely cause significant future disability. During the period of the last few decades, the survival of preterm infants has accelerated. Although, morbidity is yet such a big problem particularly for very young and extremely low birth weight infants[1].

Intra-ventricular haemorrhage (IVH) is a vital predictor of adverse neurodevelopmental outcome. IVH risk factor detection may possibly conduct betterment of standard of care in neonatal intensive care units[2].

The frequency of intraventricular haemorrhage (IVH) in very low birth weight infants may be used as an index of the quality of care in neonatal intensive care units since it is adjusted to consider the infants' risk profiles on admission to the unit, that would differs systematically from one institution to another[3]. Pathogenesis of intraventricular haemorrhage (IVH) in premature infants is multifactorial. Little bit is known with regard to the impact on of pro-inflammatory cytokine activation on the coagulation system in extremely preterm infants and its influence on the development of IVH[4]. Peri/intraventricular haemorrhage (PIVH) is usually found in prematureneonates that can cause post-haemorrhagic hydrocephalus, characterized by raised mortality rate and neurodevelopmental delay.[5] Intraventicular haemorrhage usually advances in severity and causes severe neurological morbidity and mortality. Severity of IVH is related to higher risk of developmental handicap[6]. 80-90% of patients take place between birth and 3rd day of life. Occurrence of silent haemorrhages is as high as 68% in very low birth weight infants. Probability of clinical signs and symptoms tends to increase with the intensity of haemorrhage[7]. Cranial ultrasound is a crucial part in neonatology as well as commonly used to diagnose intraventricular haemorrhage (IVH)[8].

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METHODOLOGY

The study was conducted at the Department of Radiology, Children Hospital, Institute of Child Health, Lahore from 17-02-2012 to 16-02-2013. Calculated sample size was 116 patients by taking 95% confidence interval, 6.5% margin of error and 15% expected frequency of intraventricular haemorrhage. 116 patients fulfilling inclusion criteria were selected for study. Cranial ultrasound was carried out in all neonates using standard coronal and parasagittal images, using 5 M Hz transducer through anterior fontanellae. Staging was performed using the grading suggested by Papil et al. Grade– I haemorrhage is confined to the subependymal matter. Grade–II haemorrhage is an intraventricular haemorrhage without ventricular dilatation. Grade–III haemorrhage is an intraventricular haemorrhage with ventricular dilatation. Grade–IV haemorrhage is intraparenchymal. The baseline threshold set by ultrasound machine to determine IVH more than 5 mm. A water soluble gel (aqua sonic) was used as a coupling agent. The following data was collected about gestational age, birth weight, sex, ultrasound grading and neonatal age (hours).

RESULTS

Out of 116 cases, intraventricular haemorrhage was found in 19 patients (16.4%). Mean gestational age was 32.7±6.7 and 33.1±7.2 weeks with and without IVH, respectively. Most babies developed IVH between 24-48 hours of life i.e. 47.4%. Eleven babies (31.6%) developed IVH in first 24 hours and 2 babies (21%) developed IVH after 48 hours of life. Regarding various grades of IVH, out of 19 neonates with IVH, 6 neonates (31.6%), 10 babies (52.6%), 2 babies (10.5%) and 1 baby (5.3%) had grade-I, grade-II, grade-III and grade-IV haemorrhage respectively.

Table-1: Distribution of gestational age (week)

Gestational age (week)	With IVH (n=19)		Without IVH (n=97)		Total
	No.	%	No.	%	
< 28	11	31.6	17	17.5	28
29-32	06	47.4	52	53.6	58
33-36	02	21.0	28	28.9	30
Mean±SD	32.7±6.7		33.1±7.2		

Table 2: Intraventricular haemorrhage according to age of neonates

Gestational age (hrs)	With IVH (n = 19)		Without IVH (n = 97)		Total
	No.	%	No.	%	
< 24	11	31.6	17	17.5	28
24-48	06	47.4	52	53.6	58
49-72	02	21.0	28	28.9	30
Mean±SD	31.9±3.2		58.7±4.7		

Table 3: Intraventricular haemorrhage according to gender distribution

Gender	With IVH (n = 19)		Without IVH (n = 97)		Total
	No.	%	No.	%	
Male	12	63.2	57	58.7	69
Female	07	36.8	40	41.3	47

Table 4: Ultrasound grading of patients with intraventricular haemorrhage

Grades	Number	Percentage
Grade-I	6	31.6
Grade-II	10	52.6
Grade-III	2	10.5
Grade-IV	1	05.3

Table 5: Distribution of neonates by weight (kg)

Weight (kg)	With IVH (n = 19)		Without IVH (n = 97)		Total
	No.	%	No.	%	
1-1.4	10	52.6	19	19.6	29
1.5-2.0	07	36.9	67	69.0	74
2.1-2.5	02	10.5	11	11.4	13
Mean±SD	1.54±0.4		1.7±0.3		

DISCUSSION

Intraventricular haemorrhage (IVH; also known as subependymal or germinal matrix haemorrhage) is an important cause of brain injury in premature infants. Although the incidence has declined since the 1980s, IVH remains a significant problem, as improved survival of extremely premature infants has resulted in a greater number of survivors with this condition[9]. The introduction of ultrasound has allowed frequent scanning of premature infants with intraventricular haemorrhage. Clinical presentation of intraventricular haemorrhage is often asymptomatic. Brustein et al reported that the frequency of silent haemorrhages is as high as 68% in very low birth weight infants.[7] Diagnosis of intraventricular haemorrhage is made on basis of clinical assessment and ultrasonographic evaluation[10]. Neurosonography is an excellent method for making an initial diagnosis and for follow-up [8]. The advent of cranial ultrasound as a routine tool in neonatology has greatly improved our knowledge of the presence and incidence of brain lesions in new born infants[11].

Anticipation and early identifications of IVH using cranial ultrasonography can reduce the mortality and future disabilities in surviving newborns[12]. The frequency of IVH depends on gestational age. It increases progressively with decreasing age. The same conclusion was drawn in a study conducted by Lec in which the frequency of IVH is inversely related to gestational age[13].

In present study the overall frequency of IVH was observed in 16.4%. These findings are

comparable to the studies conducted by different research groups from different parts of the world. Vural et al, from Turkey has reported 13% IVH frequency in preterm infants[14]. Another study by Köksal, claimed incidence of IVH as 15%[15]. Both these studies show a direct correlation with the results of our study. On contrary, Sandler et al demonstrated frequency of IVH 53%[16].

Rasul et al also reported high frequency of IVH i.e., 75% of premature infants[17]. This inconsistency may be due to a concentration of more critical cases at their center or biased patients selection. Incidence of IVH is inversely related to birth weight i.e., lesser the birth weight more are chances of development of IVH. In current study, majority of the neonates had birth weight 1 to 1.4Kg i.e. 52.6% with intraventricualr haemorrahge. These results are consistent with the study carried out by Perlman et al who demonstrated 54% incidence of IVH in babies with low birth weight[18]. This matter of fact was also established by a study of Kadri et al[19].

In present study, majority of IVH was found to be grade-I haemorrhage i.e., germinal matrix haemorrhage. It had a frequency of 31.6% followed by grade II haemorrhage which was 52.6%. Grade III and IV haemorrhage were less frequent. Comparable findings were reported by Perlman et al[18] and Hintz[20].

CONCLUSION

The frequency of IVH was inversely related to birth weight of the infant being more common in premature infants with low birth weights. Grade II was seen more commonly than other grades.

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