

# PERIVENTRICULAR HEMORRHAGE IN TERM NEWBORNS ORIGINATING FROM GERMINAL MATRIX

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## ABSTRACT

Six term newborns, presenting with seizures, in whom cranial sonogram showed isolated periventricular hemorrhage (SEH) are described. Age of onset of seizures ranged from day one of birth to day twenty-one. Seizures appeared spontaneously in previously healthy newborns in three cases. All but one survived, and three have near normal development. Isolation of hemorrhage to the periventricular area suggests germinal matrix to be the source of hemorrhage in these cases. These cases also emphasize the need to consider diagnosis of IVH in term-newborns presenting with seizures.

**Key words:** Periventricular hemorrhage, Germinal matrix.

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Isolated periventricular hemorrhage also known as subependymal hemorrhage (SEH) is Grade-I, intraventricular hemorrhage (IVH) of grading system described by Papille *et al.*(1). In infants born at term, intraventricular hemorrhage (IVH) has been considered a rare event(2-4). With the advent of non-invasive modalities like ultrasound and computerized tomography (CT), IVH is now being increasingly reported in term infants(2,4-7). It is well established that the hemorrhage originates from the germinal matrix in preterm infants(1,3,8). However, the source of the bleed in term neonates is not well understood. Most workers have postulated choroid plexus to be the site of the hemorrhage(4,5,9,10). The hemorrhage has, rarely been shown to be isolated only to the periventricular region(6,11), suggesting germinal matrix as the site of the hemorrhage. We report six term newborns with SEH suggesting germinal matrix to be the origin of the hemorrhage.

## Case Reports

The salient clinical profile of the six cases is summarized in the Table. All the cases except Cases 1 and 2 where feeds were not yet started, were on breast feeds. All had received Vitamin K immediately after birth. Case 1 had hypothermia at 4 hours of birth, from which she improved by rewarming and had a normal examination at 6 hours of birth. The baby, however, started convulsing at 18 hours of birth. Case 2 suffered from severe birth asphyxia and Case 5 had culture proved septicemia. There were no apparent high risk factors in Cases 3, 4 and 6. Diagnosis of SEH was made by Cranial sonogram which showed hemorrhages isolated to periventricular

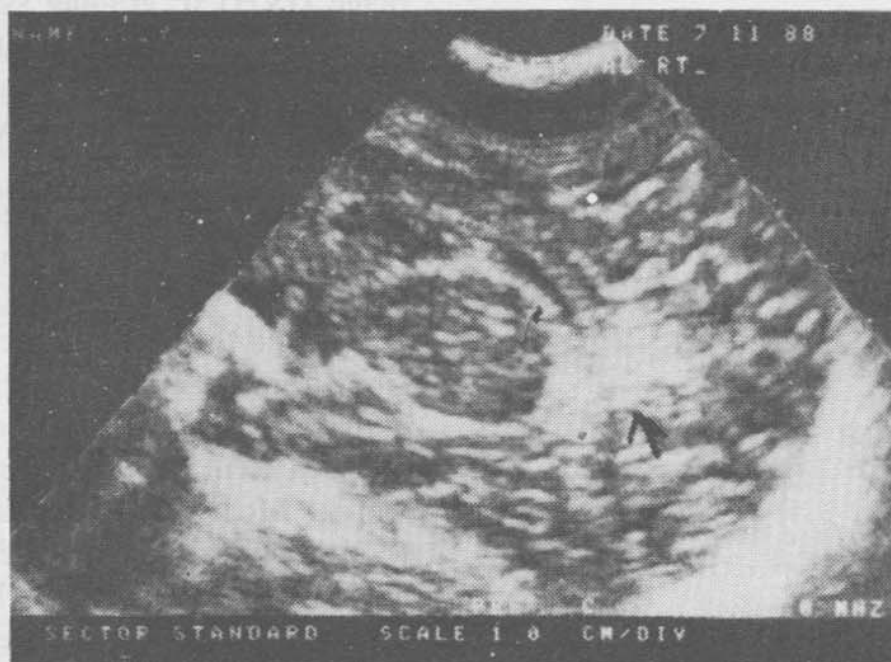


Fig. 1. Right parasagittal sonogram of Case 1 showing periventricular hemorrhage

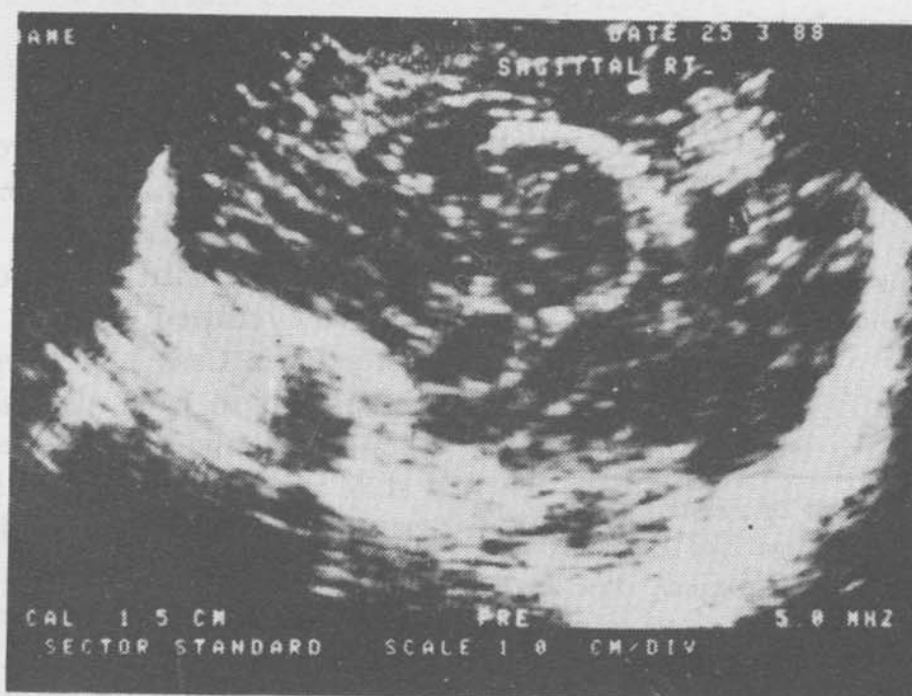


Fig. 2. Right parasagittal scan of Case 3 showing periventricular hemorrhage

TABLE--Pertinent Profile of the Six Cases

Case/ Sex	Birth weight (g)	Perinatal history	Seizure onset (days)	Presentation	Cranial sonogram	Follow-up
1/F	2600	Hypothermia	1	Gen. szs	R-SEH 1.5×1.7 cm	szs ceased after 5 days, SEH disappeared at 3 weeks, Development normal at 7 months.
2/F	2800	Post-term asphyxia	2	Depressed R-focal szs	B-SEH R-0.9×1.2 cm L-0.8×1.0 cm	szs ceased after 3 days, SEH disappeared at 8 weeks Development— mild delay at 4 months.
3/M	3250	Normal	11	Gen. szs	R-SEH 1.8×1.5cm	szs controlled with difficulty, lost to follow-up.
4/M	2500	Normal	4	Microcephaly jittery Gen. szs	R-SEH 1.1×1.5 cm	At 8 months— microcephalic developmental delay on anticonvulsants
5/M	2350	Normal	5	Poor feeding Poor NNR Tonic szs Icterus till legs	R-SEH 1.0×1.2 cm	Expired after 10 days
6/F	2500	Breech	21	Poor feeding Fever Gen. szs	L-SEH 1.0×1.5 cm	szs ceased after 7 days, SEH disappeared after 4 weeks social smile present at 2 months

szs-seizures, Gen.-Generalized, R-right, L-left, B-bilateral, SEH-subependymal hemorrhage, NNR-neonatal reflexes.

area with no extension into the ventricles (Figs. 1 & 2). The hemorrhage disappeared in 3-8 weeks time in Cases 1, 2 and 6.

Apart from cranial sonogram, additional investigations performed included complete hemogram, blood sugar, S. electrolytes, S. Calcium, blood culture and lumbar tap. Lumbar tap was not done

in Case 2, who had severe birth asphyxia. Blood culture grew *Klebsiella* in Case 5, who had septicemia. This baby also had significant bandemia and *S. bilirubin* values of 16 mg/dl (total) with 7 mg/dl (direct). In the remaining infants, all these aforementioned investigations were within normal range.

## Discussion

The association of IVH with prematurity is a known event(1,3,8). Papille *et al.*(1) stated that germinal matrix and IVH are lesions of prematurity and occur in 43% of infants weighing less than 1500 g at birth. In infants born at term, IVH is considered to be a rare event(2). Autopsy studies of the perinatal period include only a small number of term infants with IVH(2,12). Isolated periventricular hemorrhage (SEH) is still rarer in term newborns(4,11). Leech and Kohnen(8) in 184 autopsies found SEH in preterm infants only.

IVH in preterms classically emanates from small vessels, principally capillaries, in the subependymal germinal matrix(1,8,13), which is a richly vascular structure and is more pronounced in the fetus of six to eight months gestation(1). The hemorrhage can remain isolated to the subependyma or it can rupture through the ependymal lining into the ventricles. Upto 82% of SEH rupture into the ventricles to give rise to higher grades of IVH(8).

There has, however, been a total lack of agreement about the origin of hemorrhage in the full-term newborns. Most of the autopsy studies(9,10,14) have suggested choroid plexus to be the commonest site of IVH in full-term infants. Larroche(15) indicated that the posterior tufts of the choroid plexus at the glomus are frequent sites of hemorrhage in the full-term infant. Studies based on CT(2,4,5) have not given a conclusive result because CT does not reliably determine whether intraventricular blood lies within or on the surface of choroid plexus(16). Even on ultrasound one can seldom recognize the origin of the IVH unless it arises from the germinal matrix(17). The observation becomes more

reliable when the hemorrhage is localized to either inside the ventricles or to the subependyma. In all our cases, the hemorrhage was restricted to subependymal area (Grade-1 IVH). It is therefore logical to assume that the source of the hemorrhage was the germinal matrix. Germinal matrix becomes an uncommon source of hemorrhage with progressively increasing gestation because of its remodelling and gradual regression by term, but there are still some scattered islands of matrix cells in the ventricular wall and a thick cushion in the region of the caudate nucleus and thalamus(18). Some autopsy studies have also confirmed bleeding from this persistent germinal matrix(13,14). These full-term infants may represent one end of the spectrum of germinal matrix hemorrhage often associated with prematurity.

In contrast to IVH in preterms where it occurs early in life, IVH in term newborns has been reported at upto three months of age(7,11). The pathogenesis of IVH in term newborns is not yet clearly determined(4). High risk factors like asphyxia, hypernatremia, hypoxemia, acidosis and hyperviscosity have been repeatedly implicated in the reports of IVH in term infants(4-6). Lately there are reports of resurgence of association of IVH with hemorrhagic disease of newborn(11). However, there have been many cases of IVH in term infants, where no identifiable medical risk factor could be found(4,5,7).

Outcomes of IVH range from hydrocephalus and severe neurologic damage to essentially complete recovery(7). Unruptured SEH is a milder form of IVH and has a favorable outcome(3). All our cases, except Case 5, who had septicemia survived. Case 1 and 6 are developing normally, Case 2 has mild delay but also had birth asphyxia in addition. Case 4 with

developmental delay has primary microcephaly also.

This report emphasizes the need to consider IVH as a potential diagnosis in the full-term neonate who has acute neurologic findings in the immediate perinatal period or even later.

## REFERENCES

1. Papille LA, Burstein J, Burstein R, Koffler H. Incidence and evolution of subependymal and intraventricular hemorrhage: A study of infants with birth weights less than 1500 g. *J Pediatr* 1978, 92: 529-534.
2. Palma PA, Miner ME, Morriss FH Jr, Adcock EW, Denson SE. Intraventricular hemorrhage in the neonate born at term. *Am J Dis Child* 1979, 133: 941-944.
3. Volpe JJ. Neonatal intraventricular hemorrhage. *N Eng J Med* 1981, 304: 886-891.
4. Bergman I, Bauer RE, Barmada MA, *et al.* Intracerebral hemorrhage in the full term neonatal infant. *Pediatrics* 1985, 75: 488-496.
5. Scher MS, Wright FS, Lockman LA, Thompson TR. Intraventricular hemorrhage in the full-term neonate. *Arch Neurol* 1982, 39: 769-772.
6. Oelberg DG, Temple DM, Haskins KS, Bigelow RH, Adcock EW. Intracranial hemorrhage in term or near-term newborns with persistent pulmonary hypertension. *Clin Pediatr* 1988, 27: 14-17.
7. Mitchell W, O'Tuama L. Cerebral intraventricular hemorrhages in infants: A widening age spectrum. *Pediatrics* 1980, 65: 35-39.
8. Leech RW, Kohnen P. Subependymal and intraventricular hemorrhages in the newborn. *Am J Pathol* 1974, 77: 465-475.
9. Donat JF, Okazaki H, Kleinberg F, *et al.* Intraventricular hemorrhage in fullterm and premature infants. *Mayo Clin Proc* 1978, 53: 437-441.
10. Barmada MA, Moossy J. The developmental factor in neonatal cerebral vascular lesions. *J Neuropathol Exp Neurol* 1980, 39: 340.
11. Merchant RH, Divekar RM. Late hemorrhagic disease with intracranial hemorrhage. *Indian Pediatr* 1988, 25: 381-384.
12. Fedrick J, Butler NR. Certain causes of neonatal death. II. Intraventricular hemorrhage. *Biol Neonate* 1970, 15: 257-290.
13. Hambleton G, Wigglesworth JS. Origin of intraventricular hemorrhage in the preterm infant. *Arch Dis Child* 1976, 51: 651-659.
14. Lacey DJ, Terplan K. Intraventricular hemorrhage in the full-term neonates. *Dev Med Child Neurol* 1982, 24: 332-337.
15. Larroche JC. Developmental Pathology of the Neonate. New York, Excerpta Medica, 1977, pp 368-383.
16. Ludwig B, Brand M, Brockerhoff P. Postpartum CT examination of the heads of full term infants. *Neuroradiology* 1980, 20: 145-154.
17. Levene MI, Wigglesworth JS, Dubowitz V. Cerebral structure and intraventricular hemorrhage in the neonate: A real time ultrasound study. *Arch Dis Child* 1981, 56: 416-424.
18. Friede RL. Developmental neuropathology. New York, Springer-Verlag, 1975, pp 7-8.