



# “Bleeding Inside the Brain”

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Periventricular-intraventricular hemorrhage (bleeding inside the brain) is one of the major problems that premature infants may have. The incidence of PV-IVH in premature babies has decreased steadily in recent years. However, its prevalence among surviving babies is still substantial because of the increasing survival rates of babies born weighing less than 1,000 g. In 97% of cases, it occurs by day 7 of life. Diagnosis is made by ultrasound of the brain. Thus an ultrasound of the brain is done at 7-10 days of age in all premature infants less than 30 weeks gestational age. Ultrasound scanning is performed sooner if there are signs and symptoms consistent with PV-IVH.

PV-IVH is bleeding into an area of brain called the germinal matrix (cells that are multiplying to form neurons). As the baby develops, these cells migrate to other parts of brain. Thus the germinal matrix decreases in size as the baby grows. It is quite prominent at 26 to 32 weeks of gestation and is essentially involuted by term. This is one of the reasons that bleeding occurs as the gestational age at birth decreases.

There are four grades of PV-IVH. Grading is determined by the site of bleeding and the presence or absence of ventricular enlargement. Grade I is the least serious and grade IV the most serious and most likely associated with ongoing neurological problems.

**Grade I:** Is isolated hemorrhage in the germinal matrix next to the ventricle and there is no bleeding inside the ventricle.

**Grade II:** The germinal matrix hemorrhage extends into the ventricle but the ventricles are not enlarged.

**Grade III:** Intraventricular hemorrhage associated with ventricular enlargement.

**Grade IV:** In addition to grade III intraventricular hemorrhage there is bleeding within the brain tissue.

About 70% of the bleeds are Grade I-II, 20% are Grade III, and 10% are Grade IV.

The causes of the of PV-IVH bleeding are not completely clear, but it seems to be related to the regulation of blood flow and pressure within the fragile blood vessels of the germinal matrix. Wide fluctuations in blood flow and inability of the brain to regulate blood flow probably cause the bleeding. Abrupt elevations in baby's blood pressure, deprivation of oxygen, or some other insult to the developing brain can result in the rupture of the delicate blood vessels of the germinal matrix.

### **PROGNOSIS**

**Short term outcome:** in infants with PV-IVH may be considered in terms of mortality or hydrocephalus. Infants with grade III to IV PV-IVH may subsequently develop hydrocephalus, an abnormal buildup of fluid in the brain's ventricles. The most severe bleeds may even be life threatening in the newborn period.

**Hydrocephalus:** Is an abnormal collection of fluid in the baby's brain that can cause pressure on the brain tissue and can cause brain damage. This is usually diagnosed by repeated head ultrasounds. With grade III-IV IVH serial head ultrasounds are done at weekly intervals. If the ventricular size is stable on successive scans and head growth is normal, further ultrasound follow-up for hydrocephalus is probably unnecessary.

**Long-term outcome:** The most common hemorrhages (Grades I and II) are minor and do little if any harm. The incidence of neurological problems increases as the severity of the bleeding increases. Long term neurological problems consist of Cerebral Palsy (CP), seizures and mental retardation. Cerebral Palsy is defined as impaired muscular power and coordination from brain damage that presents itself as abnormalities in muscle tone and movement.

Infants with massive Grade IV bleeds who survive have little if any chance of being completely normal. Consultation with a pediatric neurologist may help parents understand the severity of the baby's condition and, in the most severe cases, help them to consider other options, such as discontinuing life support.

### **PREVENTION OF PV-IVH**

Antenatal corticosteroids given to mothers in preterm labor reduces the incidence of PVH/IVH. This apparent protective effect of antenatal corticosteroids is probably secondary to maturation of blood vessels in the germinal matrix.

**Indomethacin:** Low-dose indomethacin given to preterm babies at high risk for developing PV-IVH lowers the incidence of the most severe form of PV-IVH. It is not associated with significant adverse drug events in very low birth weight infants.

### **TREATMENT OF HYDROCEPHALUS**

If severe progressive hydrocephalus develops, surgical intervention is indicated. In such cases the neurosurgeon will place a ventricular reservoir, a tube into the ventricle which exits the skull through the top of the baby's head and ends in a reservoir placed under the skin. Fluid can then be removed from the reservoir as necessary to relieve any increased pressure on the brain. Over a period of time the excess fluid resolves and the reservoir can be removed. Sometimes if the problem persists a ventriculo-peritoneal shunt is placed, a tube connecting the ventricles and the abdominal cavity, which drains the excess fluid into the abdominal cavity.

### **CONCLUSION**

Although bleeding in the brain is a worrisome risk with premature babies, your doctor can explain further the risks for your baby and how your baby's particular situation relates to the overview presented in this article. Feel free to ask all the questions you have. We all want to see that the care your baby receives provides the best outcome possible.

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