Intracranial Hemorrhage resulting in Apneic Seizures in a Full-term infant: A Case Report and Review of Literature

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Abstract
Symptomatic spontaneous intracranial hemorrhage is rare in term neonates and the literature available on this subject is limited. In this case report, we present the clinical presentation, imaging findings and clinical course of a term neonate with neonatal seizures who was found to have intracranial hemorrhage. The available literature on this has been briefly reviewed and imaging findings and management of these newborns has been discussed in brief.

Case Presentation
A firstborn male child of a 31 year old healthy female with unremarkable prenatal course and ultrasounds who presented with multiple apneic episodes associated with cyanosis.

The pregnancy was unremarkable except for a viral gastroenteritis one month prior to delivery requiring a one day hospital stay and intravenous fluids. The labor progressed normally and the baby was delivered vaginally at 39 weeks and 2 days of gestation without instrumentation at a community hospital. Mild meconium staining was present at birth. The baby was normal on examination without evidence for cephalohematoma. Birth weight was 3.23 kilograms, APGAR (Appearance, Pulse, Grimace, Activity, and Respiration) scores were 9 at one and five minutes and child received Vitamin K injection. The baby was nursed within the first few hours without difficulty. Approximately 10 hours after delivery, parents noted multiple episodes where the baby turned blue, appeared to stop breathing and returned to normal with gentle stimulation. The episodes gradually increased in frequency and duration. Oxygen was administered, and baby was intubated and transferred to a tertiary care center with a neonatal intensive care unit (NICU). The baby was loaded with phenobarbital and further investigations were performed.

A computed tomography (CT) of the brain revealed right temporal intraparenchymal hemorrhage extending along the tentorium cerebelli (Figure 1). Magnetic Resonance Imaging (MRI) of the brain confirmed the findings with extension of the right temporal intraparenchymal hemorrhage into the right lateral ventricle with associated restricted diffusion thought to be due to the hemorrhage itself, and not underlying infarct (Figure 2). Intracranial and Extracranial Magnetic Resonance Angiography (MRA) revealed no underlying vascular anomalies. An Intracranial Magnetic Resonance Venography (MRV) revealed venous anatomic variants with a hypoplastic right transverse sinus and a small sized right sigmoid sinus. No obstruction to the venous drainage or thrombus was identified (Figure 3). Lumbar puncture demonstrated frank xanthochromia, borderline decreased glucose (49mg/dL) and elevated protein (215mg/dL). Cerebrospinal fluid (CSF) and blood cultures were negative. CSF amino acid profile, Herpes Simplex Virus 1 and 2 assays

Figure 1. Unenhanced axial CT images (A and B) and coronal CT image (C) demonstrate ill-defined hyperdensity in the right temporal region (white arrows) representing intraparenchymal hemorrhage with blood also tracking along the tentorium cerebelli.
were negative. All other blood investigations including complete blood count, basic metabolic panel, liver function tests and coagulation tests were grossly within normal limits. Initial electroencephalogram (EEG) performed demonstrated subtle changes with no definite evidence of seizures. Follow-up EEG performed in 24 hours was normal. Oral phenobarbital was continued and baby was discharged in a stable state.

The phenobarbital dosage was increased one time at approximately 3 months. The baby required a short hospital stay at 5 months due to abnormal movements but no seizure activity was identified on continuous monitoring. A repeat MRI of the brain (Figure 4) was performed at 7 months which showed localized tissue loss and residual blood products in the mid to anterior right occipitotemporal gyrus with no new abnormal findings. The child was weaned off phenobarbital over the month following the study. The child demonstrates normal development and is achieving all milestones.

Discussion

Neonatal seizure prevalence has been reported to be approximately 1.5% with an overall incidence of approximately 3 per 1000 live births. The incidence in preterm infants is very high as compared to full-term infants. Most (80%) of neonatal seizures occur within the first week of life. A study comprising 378 neonates admitted to a level three NICU over a period of 14 years demonstrated the most common etiologies to be hypoxic ischemic encephalopathy (46.0%), intracranial

Figure 2. Axial susceptibility weighted MRI (SWI) imaging (A and B) which is a sequence sensitive to compounds which distort the local magnetic field like blood products, calcium etc. Images A and B demonstrate intraparenchymal hemorrhage in the right temporal lobe extending to the adjacent temporal horn of the right lateral ventricle (white arrows) and partially effacing it. Axial diffusion weighted MRI image (C) which is a sequence in which highly cellular tissues or those with cellular swelling exhibit lower diffusion coefficients and is useful in cerebral ischemia. However, the hyperintensity corresponding to the area of hemorrhage (white arrow) which represents restricted diffusion is thought to be due to the hemorrhage itself and not ischemia.

Figure 3. Representative coronal maximum intensity projection (MIP) MRA images (A), sagittal MIP MRV image (B) and axial MRV image (C) demonstrate no vascular malformation or venous thrombosis.

Figure 4. Axial susceptibility weighted MRI (SWI) imaging (A and B) and axial diffusion weighted MRI image (C) of the follow-up MRI performed 7 months later demonstrate residual tissue staining with mild localized tissue loss in the right temporal region with no new abnormalities. The diffusion weighted imaging demonstrated no evidence of restricted diffusion.
hemorrhage (12.2%), and perinatal arterial ischemic stroke (10.6%).

Neonatal intracranial hemorrhage (ICH) is commonly related to prolonged or precipitous delivery, vaginal breech delivery, instrumental delivery, and primiparity or extreme multiparity. ICH can cause neurological symptoms such as a tense or bulging fontanelle, increasing head circumference, apnea, bradycardia, and/or seizure. In full-term neonates with intracranial hemorrhage, acute symptomatic seizures have been shown to be a presenting symptom in more than two-thirds. ICH has five major clinical presentations: subdural hemorrhage (SDH), primary subarachnoid hemorrhage, cerebellar hemorrhage, intraventricular hemorrhage and intraparenchymal hemorrhage. SDH and intraparenchymal hemorrhage are more common in term neonates, while the rest are more common in preterm infants. Asymptomatic ICH following vaginal delivery in full-term infants has been shown to have a prevalence as high as 26%, of which intraparenchymal hemorrhage has been shown to be the second most common cause, following subdural hemorrhage.

Symptomatic spontaneous intraparenchymal hemorrhage is thought to be extremely rare in full-term newborns and literature available on this is limited. Sandberg et al identified no underlying cause in more than 50% of full-term neonates with spontaneous intracranial hemorrhage. Remaining cases were due to coagulopathy, ruptured intracranial aneurysm or hemorrhagic infarction. When radiographic evidence of mass effect or signs of elevated intracranial pressure is found, surgical hematoma evacuation may be necessary. The authors concluded that outcomes vary considerably or may even be normal, even in patients with large intraparenchymal hemorrhages.

In full-term newborns, ICH with parenchymal involvement carries a risk of adverse neurological sequelae with a mortality of 34.5% and development of cerebral palsy in 8.6% and should be promptly recognized. The high mortality rate is often attributed to perinatal asphyxia. Infants with supratentorial ICH have a slightly lower, although not statistically significant mortality rate compared with infants with infratentorial or combined ICH. Majority of the survivors (88.2%) without cerebral palsy have been reported to have a normal neurodevelopmental outcome at 15 months. Jhawar et al have demonstrated that infants with ICH at full-term in a study with a median follow-up of 3 years (range 1.0-10.9) had better outcomes when the ICH occurred following a spontaneous vaginal delivery. Hemorrhage location within the brain seems to contribute to the outcome. Hemorrhage in the frontal lobe was found to be the most disabling especially if multiple compartments were involved. In their multivariate analysis among factors such as thrombocytopenia, increasing overall hemorrhage severity, frontal location and spontaneous vaginal delivery, only thrombocytopenia remained significant for physical disability (Odds Ratio 7.6) and borderline significant for cognitive disability (Odds Ratio 4.6). Their study also showed that 57% of infants had no physical or cognitive deficits at follow-up. Death occurred most frequently among those with primarily subarachnoid hemorrhage (19%) and the most favorable outcomes occurred among those with subdural hemorrhage (80% had no disability). An earlier study on intracerebral hemorrhage in full-term neonatal infants demonstrated that more than 50% had normal follow-up assessments. Of the patients with abnormal follow-up assessments, 25.0% had perceptual difficulties, 37.5% had cognitive deficiencies and 37.5% had severe mental and neurologic handicaps. Most infants with no known precipitating cause for their hemorrhage developed normally.

The most important prevention of intracranial hemorrhage in term newborns is successful accomplishment of vaginal delivery with or without obstetric instrumentation. Forceful vaginal delivery should not be attempted. Medical interventions should be implemented on the first clinical suspicion of ICH. The goal of medical therapy is to provide adequate ventilation, prevent metabolic acidosis, keep vital organs perfused and to control seizure activity. Any treatable etiological factor (e.g. sepsis, dehydration, thrombocytopenia, vitamin K deficiency or coagulopathy) should be identified and treated promptly.

**Conclusion**

Spontaneous intracranial hemorrhage is rare in term neonates and patients can be symptomatic or asymptomatic. Intracranial hemorrhage is the second most
common cause of neonatal seizures. No underlying cause is identified in more than half of term neonates with intraparenchymal hemorrhage. The outcome following intraparenchymal hemorrhage is variable, but can carry a mortality rate of around 30% and hence should be promptly recognized and medical interventions should be implemented on the first clinical suspicion.

References