

Light without TORCH: Periventricular Haemorrhage and Group B Streptococcal Meningitis in a Neonate

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ABSTRACT

Post-infectious hydrocephalus is a common entity needing attention of paediatricians and neurosurgeons. Periventricular Haemorrhage (PVH) affects both preterm and term babies. Risk factors include male gender, short gestation, labour and vaginal delivery. Congenital infections such as Toxoplasma and CMV are associated with hydrocephalus and intracranial calcification. We present an unusual association of Group B Streptococcal infection with periventricular haemorrhage. A Caucasian female was born at 37 weeks gestation by normal vaginal delivery. Birth weight was 2.72kg and OFC was 33cm (50th centile). There were no antenatal problems or maternal infections. On day 2 of life, the patient presented with unusual cry, lethargy and reduced feeding. Group B Streptococcal meningitic septicaemia was confirmed with positive CSF and blood cultures. At 7 weeks, she presented with a two-week history of increasing head circumference. Ventriculo Peritoneal (VP) shunt was inserted for post-infectious hydrocephalus. There was difficulty in waking the patient up post-operatively and subsequent CT Brain showed the presence of multiple high attenuation foci in the periventricular region suggestive of haemorrhage or calcification. MR imaging confirmed numerous foci of abnormal signal intensity in the periventricular white matter, most likely blood products. To our knowledge, this is the first report of an association between Group B Streptococcal meningitis and PVH.

Keywords: Periventricular haemorrhage, Group B *Streptococcus*, Meningitis, Neonate.

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INTRODUCTION

Periventricular Haemorrhage (PVH) primarily affects premature infants.¹ However, it is also known to occur in term infants, affecting 1.6% of those born at 37-43 weeks gestation.² It has been suggested that the aetiology of PVH is multifactorial.³ Risk factors for PVH in the term infant include male gender, lower birth weight,³ perinatal asphyxia,^{4,5} and mode of delivery.^{3,6} Group B *Streptococcus* is a common cause of neonatal sepsis and meningitis.⁷ Infections occurring from birth to day 6 are referred to as Early Onset Disease (EOD)⁸ and are usually due to vertical transmission from a colonised mother.⁷ Known sequelae of EOD include neurodevelopmental morbidity and hydrocephalus.⁹ We report an unusual association of Group B Streptococcal meningitis with PVH.

Summary of Case

History

A Caucasian female was born at 37 weeks gestation by normal vaginal delivery after spontaneous onset of labour. There were no antenatal problems or maternal infections, nor was there preterm premature rupture of membranes. Maternal serology was negative. There were no perilabour maternal pyrexias and neonatal resuscitation was not required after birth. Birth weight was 2.72kg and Occipito-Frontal Circumference (OFC) was 33cm (50th centile). On the second day of life, the patient presented with an unusual cry, lethargy and reduced feeding. Group B *Streptococcus* (GBS) meningitic septicaemia was diagnosed following GBS growth in blood cultures after 12hr and 2 GBS positive CSF samples. Cytomegalovirus (CMV) and Toxoplasma serology was negative. MRI Brain at five days was normal. The patient recovered after 3 weeks of intravenous antibiotic treatment.

Seven weeks after birth, the patient presented with a two-week history of increasing head circumference. She was referred to our institution for neurosurgical assessment and possible Ventriculoperitoneal (VP) shunt insertion.



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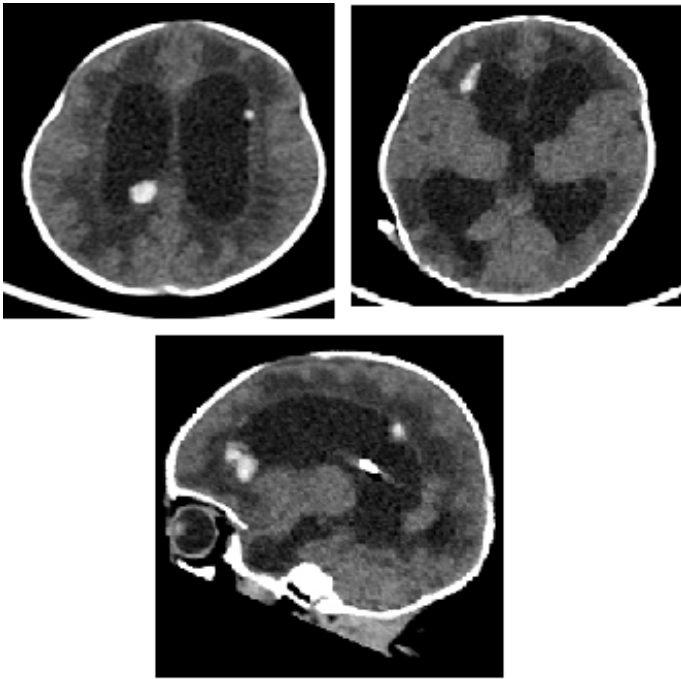


Figure 1: Axial and sagittal sections demonstrating periventricular haemorrhagic lesions.

Examination

On examination, temperature was 37.6°C, pulse rate was 168, respiratory rate was 30, oxygen saturation was 100%, and capillary refill time was < 2sec. Occipito-Frontal Circumference (OFC) was 40.1cm (>99th centile for Corrected Gestational Age of 4.5 weeks). Weight was 4kg (25-50th centile). A bulging fontanelle was present and there was intermittent sunseting. Eye examination showed pink discs with no papilloedema. The rest of the physical examination was normal. She went on to have VP shunt insertion for post-infectious hydrocephalus.

Post-operative Course

There was difficulty waking the patient post-operatively and CT Brain showed the presence of multiple high attenuation foci in the periventricular region suggestive of haemorrhage or calcification (Figure 1). Magnetic Resonance Imaging (MRI) confirmed numerous foci of abnormal signal intensity in the periventricular white matter, most likely blood products, confirming the diagnosis of periventricular haemorrhage (Figure 2). As this is limited to the germinal matrix, it is a Grade I PVH. Subsequent coagulation profile was normal. Repeat MRI Brain at three months showed resolution of the periventricular haemorrhages. At six-month follow-up, she had bilateral hearing loss but was otherwise developmentally normal. She has since had a cochlear implant inserted. She remains seizure free.

DISCUSSION

Intracranial Haemorrhage (ICH) is rare in the neonate.^{10,11} It is generally subarachnoid or intraventricular in location and associated with prematurity.¹²⁻¹⁴ Intraparenchymal haemorrhage

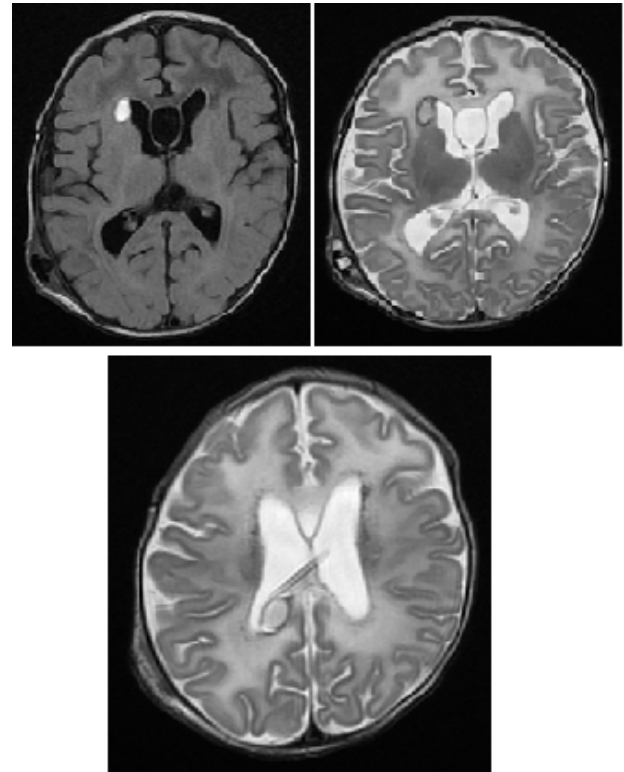


Figure 2: Axial and sagittal sections demonstrating periventricular haemorrhagic lesions.

is also rare, being mainly described in case reports and small series of patients.^{11,13,15-24} A number of studies have found an association between neonatal intracranial haemorrhage and specific delivery methods such as forceps assistance, ventouse extraction, and Caesarean section.^{16,25,26} Looney *et al.* found that vaginal delivery was strongly associated with neonatal ICH.²⁷ They also found there was no association between ICH and traumatic or assisted vaginal delivery in a group of 88 neonates with a mean age of 20.8 days. While our patient was delivered via normal vaginal delivery, imaging prior to shunt insertion showed no evidence of ICH, suggesting the delivery method is an unlikely aetiological factor in the PVH.

Possible Aetiopathogenesis

PVH and Intraventricular Hemorrhage (IVH) are well-known complications of prematurity, caused by the fragility of blood vessels in the subependymal germinal matrix.²⁸ However, PVH has also been described in the full-term infant.^{3,12,29} The germinal matrix supports the division of glioblasts and differentiation of glial elements until approximately 32 weeks' gestation, at which time regression is nearly complete. Cells of the germinal matrix are rich in mitochondria and, therefore, are quite sensitive to ischemia. PVH-IVH hemorrhage is now thought to be caused by capillary bleeding. Loss of cerebral autoregulation and abrupt alterations in cerebral blood flow and pressure are two major factors that contribute to the development of PVH-IVH. Multiple

events can result in rapid changes in the cerebral circulation, potentially overwhelming the impaired autoregulatory mechanisms of the neonate. These events include asynchrony between spontaneous and mechanically delivered breaths; birth; noxious procedures of caregiving; instillation of mydriatics; tracheal suctioning; pneumothorax; rapid volume expansion (isosmotic or hyperosmotic as in sodium bicarbonate); rapid colloid infusion (e.g., exchange transfusion); seizures; and changes in pH, PaCO₂, and PaO₂.^{2,3,18} Some of these changes (asynchrony between spontaneous and mechanically delivered breaths, tracheal suctioning, changes in pH, PaCO₂, and PaO₂) can occur perioperatively and during the administration, maintenance and weaning of anaesthesia. This is a possible aetiological factor in this patient's PVH. The points that go against this theory are that this was a term baby and the bleed occurred in the seventh week of life.

GBS is frequently implicated in neonatal sepsis and meningitis.⁷ Neonatal meningitis carries a risk of neurodevelopmental disability and death. Early mortality rates were reported to be 20-30%.^{9,30,31} More recently, Libster *et al.* reported 10 deaths in a series of 90 infants with GBS meningitis.³⁴ It has been shown in experimental models that GBS alters cerebral blood flow regulation and cerebral perfusion, causes blood-brain barrier disruption, and impairs cerebral vascular reactivity to acute hypercarbia.^{32,33} A possible alteration in cerebral autoregulation caused by GBS infection, along with the probable perioperative changes mentioned above, may have led to the haemorrhage in this case.

In the acute phase of GBS infection, reported imaging findings include extra-axial fluid collections and ischaemia or infarct while longer-term imaging findings are infarction, encephalomalacia and hydrocephalus.³⁴ Hydrocephalus is a frequent sequela of GBS meningitis. Fluegge *et al.* reported that 50% of infants in their series developed hydrocephalus as a consequence of GBS meningitis.³⁵ Wald *et al.* reported that 6 out of 74 patients developed hydrocephalus after GBS meningitis.⁹ Infarction is a rarer complication of GBS meningitis. Hernández *et al.* described a series of eight patients with ischaemic infarction as a result of GBS meningitis.³⁶

Other possible aetiological factors are coagulopathy and structural abnormality. Coagulopathy has been rarely associated with intracranial, and specifically spontaneous intraparenchymal, haemorrhage in the neonate.^{10,11,16,37} Structural abnormalities e.g., aneurysm, arterio-venous malformation, cavernoma and neoplasm, are extremely rare causes of neonatal ICH.^{11,38} However, these have been ruled out in our patient as there was a normal coagulation profile and no structural abnormality identified on MRI. Intraventricular haemorrhage after VP shunt insertion is rare, with a rate of 4% in a long-term series.³⁹ In this case, the distribution and location of the haemorrhages are unusual for bleeds secondary to shunt insertion.

Prevention

There remains considerable debate around antenatal screening for GBS and the use of prophylaxis. The incidence of Early-onset GBS disease in the UK and Ireland, where there is no systematic screening or routine use of Intrapartum Antibiotic Prophylaxis (IAP), is 0.5/1000 live births.⁴⁰ This is similar to the USA, where there is universal screening and routine administration of IAP. A review of sepsis-related neonatal mortality in the USA showed a decline in mortality in the first week after birth which coincided with the introduction of IAP.⁴¹ In contrast, a Cochrane review found that, while IAP for colonised mothers reduced the incidence of early onset GBS disease, it has not been shown to reduce all causes of mortality or GBS-related mortality.⁴² Based on the current level of evidence, the Royal College of Obstetricians and Gynaecologists does not recommend routine screening of all pregnant women for GBS colonisation.⁴³ However, the guidelines do recommend the offering of IAP to women who have been found to be colonised during the current pregnancy.

CONCLUSION

A literature search of Medline and Embase using the search terms "Group B *Streptococcus*" and "periventricular haemorrhage" revealed no results. Therefore, we believe this is the first reported case of PVH in association with GBS meningitis. Other causes of PVH such as trauma and coagulopathy have been ruled out. It has been postulated that dysfunction of cerebral autoregulation caused by GBS may have led to the PVH. Current guidelines do not recommend routine screening for GBS in pregnant women but they should be offered antibiotic prophylaxis if found to be colonised on investigation for clinical reasons.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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