Case Report

A case report of perinatal arterial ischemic stroke: Silent cause behind neonatal seizures

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ABSTRACT

Perinatal arterial ischemic stroke (AIS) is a significant cause of neonatal seizures and long-term neurological morbidity, typically involving focal brain injury within an arterial territory. While most cases present in the neonatal period, some are diagnosed later as presumed perinatal AIS. We report a term male neonate, born via elective cesarean section to healthy, non-consanguineous parents with no identifiable risk factors. At 24 h of life, he developed right-sided focal seizures. Neurological and metabolic evaluations were unremarkable. Magnetic resonance imaging revealed an acute infarct in the left parietal lobe, insular cortex, and thalamus within the middle cerebral artery territory. Angiography was normal. Seizures were controlled with antiepileptics. This case highlights that perinatal AIS can occur even in low-risk neonates and may present solely as seizures. Timely neuroimaging and intervention are essential for accurate diagnosis and improved outcomes. A high index of suspicion is critical to minimizing long-term neurological sequelae.

Key words: Neonatal seizures, Neuroimaging, Perinatal arterial ischemic stroke

Ischemic perinatal stroke was defined as"a group of heterogeneous conditions in which there is a focal disruption of cerebral blood flow secondary to arterial or cerebral venous thrombosis or embolization, between 20 weeks of fetal life through 28 postnatal days, confirmed by neuroimaging or neuropathologic studies" [1]. It causes brain injury by a disruption in blood flow, either in an isolated or widespread manner, due to issues with arterial or venous circulation. This type of stroke can occur during the prenatal, intrapartum, or postnatal periods. Perinatal stroke is divided into six subtypes based on when the injury occurs, including neonatal arterial ischemic stroke (NAIS), presumed perinatal arterial ischemic stroke (PPAIS), neonatal hemorrhagic stroke, presumed perinatal hemorrhagic stroke, neonatal cerebral sinovenous thrombosis, and periventricular venous infarction [2]. In term infants, NAIS is the most common cause of cerebral palsy and the second most frequent cause of neonatal seizures.

Various risk factors for perinatal stroke have been identified, which can be categorized into maternal, placental, intrapartum, and neonatal factors. Perinatal stroke is thought to be multifactorial, with the risk escalating when multiple factors are present. A recent study revealed that many risk factors overlap between NAIS and hypoxic-ischemic encephalopathy (HIE), suggesting a potential link between the two conditions. In fact, these conditions co-occur in approximately 5% of HIE cases [2]. NAIS typically presents within the 1st few days of life, most commonly with acute symptoms such as seizures, and less frequently with non-specific signs such as encephalopathy, poor feeding, or abnormal muscle tone. Focal neurological deficits, such as hemiparesis, are rarely seen. In contrast, PPAIS is often diagnosed later, typically in infancy or childhood, as symptoms appear more gradually. Infants with PPAIS are usually asymptomatic at birth but may develop hemiparesis months or even years later [3].

This case report highlights a newborn who developed seizures within 24 h of birth and was diagnosed with perinatal arterial ischemic stroke (AIS) after a thorough investigation. This case underscores the need to consider perinatal stroke in the differential diagnosis of neonatal seizures, even in the absence of identifiable risk factors.

CASE REPORT

A term male baby born via lower segment cesarean section (LSCS) in view of previous LSCS with a birth weight of 3.5 kg at an outside hospital. He was born to a G2P1L1 mother, a non-consanguineous marriage, with no antenatal risk factors. Baby cried immediately after birth with APGAR scores of 1'–7 and 5'–9 and was shifted to the mother's side. The mother

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noticed abnormal jerky movements on the right side of the upper limb at around 24 h of life. The baby was then shifted to the neonatal intensive care unit and was observed to have right-sided focal seizures involving the upper and lower limbs. With this history, the baby was then referred to our hospital at 36 h of life.

At admission, vitals were stable. No morphological abnormalities were noted. Neurological examination was also normal. Blood investigations, including the metabolic parameters, were normal. Electrocardiography showed left parietal epileptiform discharges. Magnetic resonance imaging revealed an acute infarct in the left parietal lobe, insular cortex, and thalamus (middle cerebral artery territory), with a normal angiogram (Fig. 1). Antiepileptic treatment controlled the seizures, and the baby had no further seizures post-admission. Now, the child is 1 year old and is seizure-free, but is noted to have a mild weakness in the right upper limb and is on physiotherapy for the same.

DISCUSSION

Perinatal arterial stroke (PAS) is the leading cause of hemiplegic cerebral palsy, resulting from a complex combination of maternal, placental, and neonatal factors. Infertility, often associated with ovarian hyperstimulation syndrome, has been identified as an independent risk factor, contributing to hypercoagulable states. Pre-eclampsia, another significant maternal risk, leads to placental vascular defects and impaired uteroplacental blood flow, which in turn increases the likelihood of neonatal complications such as encephalopathy and motor impairments such as cerebral palsy. Placental conditions such as chorioamnionitis and infarction also play critical roles in PAS, with chorioamnionitis being particularly linked to early diagnoses of the condition [4].

Neonatal factors, including congenital heart disease, polycythemia, and infections, further complicate the risk of PAS. Thromboembolic events originating from the placenta, heart, or vessels are thought to be central to the development of PAS, particularly when placental dysfunction and inflammation are present. Key risk factors such as chorioamnionitis, pre-eclampsia, prolonged rupture of membranes, and infertility account for a substantial percentage of PAS cases, underscoring the need for further research into the interconnections between maternal, placental, and neonatal factors in preventing and managing PAS effectively [4,5].

The brain's stage of development at the time of injury profoundly influences the extent and nature of the resulting damage. In preterm infants, hypoxia-ischemia occurs during a vulnerable period for oligodendrocyte progenitors, which are particularly sensitive to excitotoxicity, oxidative stress, and inflammation. This disrupts their maturation into myelinating oligodendrocytes, compromising white-matter development and increasing susceptibility to conditions such as periventricular white-matter injury and cerebral palsy. Subplate neurons, essential for visual thalamocortical projections, are also vulnerable at this stage, leading to lasting functional deficits. In contrast, full-term infants tend to experience more focal brain injuries affecting gray-matter regions such as the striatum, thalamus, and cortex, with a less diffuse distribution [6,7].

Seizures are the most common clinical symptom of symptomatic NAIS, occurring in approximately 70–90% of cases. These seizures tend to appear at a median postnatal age of 19 h, with 81% occurring within the first 36 h, a timeline that distinguishes them from seizures caused by generalized hypoxic-ischemic events. Additional clinical manifestations of NAIS include diffuse neurologic symptoms, focal signs such as lateralizing hemiparesis (present in 95% of affected cases), and systemic issues such as respiratory and feeding difficulties, which help differentiate NAIS from other neonatal conditions (Fig. 2) [2].

When diagnosing perinatal stroke, it is crucial to consider and rule out other potential causes of focal brain lesions, such as kernicterus, infectious encephalitis, mitochondrial disorders, posterior reversible encephalopathy syndrome, intracranial tumors, non-accidental injury, and neonatal hypoglycemia-related infarction, to ensure an accurate diagnosis [8].

Imaging studies play a crucial role in diagnosing NAIS and assessing the extent of brain injury. In the acute phase, diffusion-weighted imaging reveals restricted diffusion, which is most pronounced in the first 4–6 days after the stroke. This restricted diffusion is followed by a pseudonormalization period around days 7–9. Areas of network injury, such as the corpus callosum and corticospinal tracts (CSTs), are also detected. Injury to the CST is strongly associated with poor motor outcomes, including unilateral cerebral palsy. In the subacute phase (1–3 weeks), T1-weighted imaging shows cortical hyperintensity and cerebral peduncle atrophy, indicating motor tract degeneration [9].

Chronic-stage imaging (3 weeks and beyond) often reveals volume loss and gliosis, highlighting the long-term effects of the stroke. The radiological appearance varies depending on the timing of the insult, with early injuries potentially leading to schizencephaly or porencephaly, whereas later injuries typically result in encephalomalacia and gliosis. Vascular abnormalities are common in PAS, with magnetic resonance angiography identifying occlusions, flow defects, carotid artery dissections, and anatomical variants. These findings are essential for

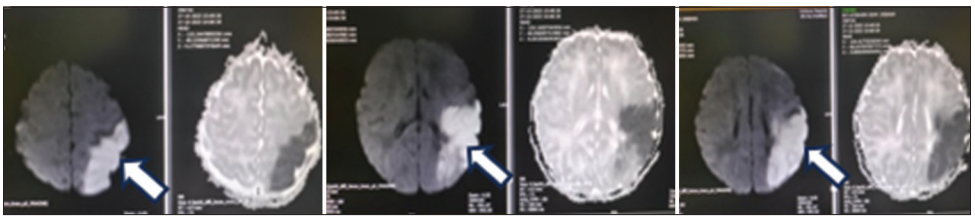

Figure 1: Magnetic resonance angiography brain shows – an acute infarct in the left parietal lobe, insular cortex, and thalamus (middle cerebral artery territory), with normal angiogram

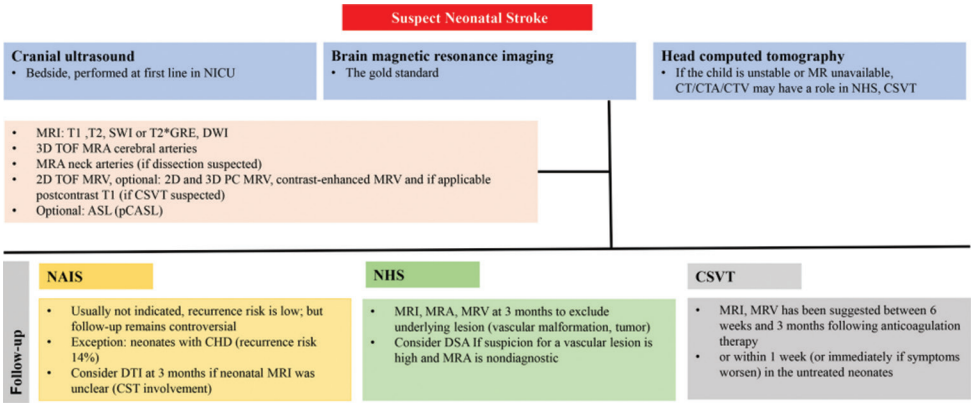

Figure 2: Approach to a neonate with suspect stroke [2]

diagnosing PAS and understanding its long-term effects [2].

While there are no immediate, established treatments for perinatal stroke, early detection and intervention remain critical for minimizing long-term disabilities such as cerebral palsy. The outcomes of symptomatic perinatal stroke vary: approximately 50% of affected neonates develop hemiplegic cerebral palsy, 35% achieve normal outcomes, and the remainder experience mild motor deficits. Given the absence of clear preventative strategies, the focus has shifted to promoting neuroplasticity in the early developmental stages. Significant changes in the nervous system, especially in the CST, occur within the 1st year of life. After a unilateral stroke, the affected hemisphere's corticospinal projections face a competitive disadvantage, while projections from the unaffected hemisphere remain intact. The key to improving outcomes lies in early interventions that can guide the development of the CST toward a more typical pattern [10].

New therapies are being explored to harness the brain's plasticity during this critical developmental window. Approaches such as constraint-induced movement therapy and intensive bimanual therapy have been used in children with established hemiplegic cerebral palsy, but they show promise in younger infants if applied early. Non-invasive brain stimulation techniques such as transcranial direct current stimulation and repetitive transcranial magnetic stimulation have also demonstrated potential for modulating cortical excitability and improving motor outcomes, suggesting they may be useful for infants with perinatal stroke. Neuroprotective strategies, including induced hypothermia, antioxidants (such as melatonin), anti-inflammatory agents (such as minocycline), and growth factors such as erythropoietin, are being investigated for their potential in treating neonatal brain injury. IN addition, stem cell therapies offer hope for mitigating long-term morbidity. By targeting interventions during the critical period of CST development, there is an opportunity to positively influence outcomes, though further research is needed to refine these approaches and determine their effectiveness [10,11].

CONCLUSION

Perinatal AIS remains an underrecognized yet important cause of neonatal seizures and long-term neurological impairment. This case emphasizes that AIS can occur even in term neonates without identifiable risk factors and may present solely with focal seizures. Prompt recognition, early neuroimaging, and appropriate management are critical in improving outcomes and minimizing long-term sequelae such as cerebral palsy. Clinicians should maintain a high index of suspicion for AIS in any neonate presenting with unexplained seizures, as timely diagnosis enables early intervention, parental counseling, and tailored neurodevelopmental follow-up. Further research is essential to better understand the etiopathogenesis of AIS and develop effective preventive and therapeutic strategies.

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