Commentary

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The Growing Concern of Propofol-Related Infusion Syndrome in Pediatric Care

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Description

Propofol, a short-acting intravenous sedative-hypnotic, is frequently utilized in Intensive Care Units (ICUs) and pediatric anesthesia owing to its rapid onset and beneficial pharmacokinetics. Nevertheless, despite its prevalent use and established safety profile, administering propofolespecially at high doses or for extended durationscan result in a potentially life-threatening condition known as Propofol-Related Infusion Syndrome (PRIS). This syndrome, although uncommon, poses a significant risk of morbidity and mortality, particularly in pediatric patients. The link between PRIS and multiorgan failure, alongside neurological symptoms such as encephalopathy and ischemic brain injury, calls for a meticulous strategy in diagnosis, monitoring and management. This article addresses the rising concerns regarding PRIS in pediatric care, its neurological consequences and the necessity for early identification and intervention.

Understanding Propofol-Related Infusion Syndrome (PRIS)

PRIS is an uncommon but serious complication that usually arises in patients undergoing prolonged propofol infusions, especially those receiving higher doses. The precise mechanisms behind PRIS are intricate and remain under active investigation. Nevertheless, it is thought to involve mitochondrial dysfunction, leading to decreased ATP production and cellular hypoxia, which causes widespread organ system failure. Typical symptoms include metabolic acidosis, rhabdomyolysis, cardiac arrhythmias, renal failure and severe lactic acidosis, which can swiftly advance to multiorgan failure.

While PRIS is more frequently identified in adult populations, it is increasingly observed in pediatric patients, particularly infants under three years old, who are at greater risk due to their developing mitochondrial function. Research has indicated that the syndrome is more likely to manifest when propofol is given at doses of 4 mg/kg/hour or higher for prolonged durations (exceeding 48 h). Unfortunately, the severity and unpredictability of the syndrome can complicate early detection.

Neurological implications of PRIS: A silent threat

In pediatric patients, especially infants, the neurological effects of PRIS can be both significant and often overlooked. Although the more widely recognized aspects of PRIS are metabolic in nature, the neurological symptoms can vary from subtle changes in mental status to severe encephalopathy and ischemic brain injury. This has been illustrated in various case reports, including one involving a five-month-old infant who developed substantial neurological issues following propofol infusions lasting over 55 h.

In this instance, the infant showed bilateral symmetric restricted diffusion in regions such as the thalami, dentate nuclei and cerebellar hemispheres. These brain areas are highly metabolically active and thus particularly susceptible to mitochondrial dysfunction. Such findings frequently occur in cases of mitochondrial encephalopathy and while PRIS shares similar characteristics with these conditions, the mechanism for brain involvement in PRIS is believed to stem from ATP production failure, leading to neuronal injury. These brain anomalies may not be immediately visible on standard imaging, making it essential to monitor pediatric patients receiving propofol with advanced imaging methods like MRI.

The neurological signs of PRIS are often subtle in the initial phases, but as the condition advances, patients may exhibit symptoms of encephalopathy, seizures and altered consciousness, as observed in the case of the five-month-old patient. This highlights the necessity for careful monitoring of neurological decline in high-risk individuals. Failure to quickly identify and address these symptoms can lead to irreversible neurological damage, lasting disabilities or even death.

The role of advanced imaging in early diagnosis

Since neurological complications of PRIS can be subtle and sometimes overlooked in early phases, advanced neuroimaging is essential for diagnosis and monitoring. Specifically, MRI with Diffusion-Weighted Imaging (DWI) sequences demonstrates high sensitivity in identifying early ischemic alterations in the brain. Findings such as restricted diffusion in the thalami, cerebellum

and dentate nuclei may provide vital insights into the extent and severity of brain injury in PRIS patients.

In the case of the five-month-old infant, MRI revealed symmetric restricted diffusion in both thalami and dentate nuclei, which aligned with regions of impaired mitochondrial function. This pattern of lesions in areas with high metabolic demands was important for diagnosing the underlying neurological damage. Notably, these abnormalities may persist or evolve over time, emphasizing the importance of follow-up imaging to evaluate the degree of brain injury and track recovery.

In conclusion, PRIS poses a significant challenge in pediatric critical care, with risks of severe multiorgan failure and neurological damage. Although it is still a rare condition, its serious consequences necessitate careful consideration when administering propofol, especially for extended durations. By remaining vigilant, utilizing advanced imaging methods and providing prompt intervention, healthcare practitioners can enhance the prognosis for children affected by PRIS and reduce the long-term effects of this debilitating syndrome.