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PERIOPERATIVE ANESTHETIC MANAGEMENT OF PEDIATRIC PATIENTS WITH VENTRICULAR ASSIST DEVICES REQUIRING NEUROSURGICAL INTERVENTION: A CASE SERIES REVIEW

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Description

The incidence of neurological complications in pediatric patients with ventricular assist devices (VADs) remains high at 23% (1) and includes life-threatening conditions such as ischemic stroke, hemorrhagic stroke, and subdural hemorrhage. Although there are no clear management guidelines, operative interventions are increasingly offered to patients who have sustained a neurological event. Potential perioperative concerns include bleeding, VAD thrombosis, transfusion-related events, and secondary brain injury. This case series describes the perioperative anesthesia management of pediatric VAD patients at our center who underwent neurosurgical intervention from April 2014-January 2020.

Discussion

Eighty-five pediatric patients underwent VAD implantation during this period. Fifteen (17.6%) neurologic events were recorded, one-third (5 cases) of which were surgically intervened upon: 2 patients underwent emergent bedside extraventricular drain placement and 3 underwent operative procedures (1 Burr hole with hematoma evacuation, 2 hemicraniectomies). 4 patients sustained an intracranial hemorrhage and 1 an ischemic stroke. Mean time between VAD implantation and neurologic event was 58.6 days. Three of 5 patients had a left VAD, 1 a right VAD, and 1 a single ventricle VAD. Four patients had a HeartWare VAD and one had a Berlin Heart VAD. Three of 5 patients were on warfarin and received emergent reversal with prothrombin complex concentrate and vitamin K. Four of 5 patients had impending or active herniation with deteriorating neurologic status requiring emergent intervention and were treated with pharmacological brain relaxants. All 3 patients who underwent operative intervention received invasive hemodynamic monitoring, a combination of crystalloid and colloid to maintain VAD preload and were supported with inotropes. The two patients who underwent hemicraniectomies were on clevidipine to optimize VAD afterload and received intraoperative blood transfusions, one of whom required a massive blood transfusion. Anesthesia was maintained with total intravenous anesthesia in 1 patient while the other 2 received a combination of volatile and intravenous anesthesia. Mean duration of anesthesia for the 3 intraoperative cases was 4.8 hours. Two patients survived to transplant without significant neurologic deficits, 2 died from the severity of neurologic injury, and 1 remains critically ill.

As the number of children on VAD support increases, adverse neurological events requiring surgical intervention is likely to rise. Anesthesia providers should be aware of the physiological differences between types of VADs and anticipate protecting/supporting the non-mechanically assisted ventricle. Intraoperative anesthetic management goals include maintaining adequate VAD preload and cerebral perfusion pressure (CPP). For patients with cerebral edema and herniation, increasing afterload to maintain CPP should be balanced with maintaining adequate VAD output. Management

of anticoagulation reversal and bleeding requires close communication with involved providers given the potential for VAD thrombosis. A multidisciplinary approach to perioperative management is essential for optimal patient outcome.

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