Comparison of the systemic hemodynamics of sevoflurane and ketamine for anesthesia induction in children with congenital heart disease

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Objective:
Sevoflurane and ketamine are commonly used for pediatric anesthesia during cardiopulmonary bypass (CPB). Comparison of the two agents on hemodynamics has been largely based on clinical indirect indicators. Pressure recording analytical method (PRAM) is a new and direct systemic hemodynamic monitoring technique based on mathematical analysis of the peripheral arterial waveform. We aimed to compare the effects of sevoflurane and ketamine on systemic hemodynamics using PRAM in children undergoing CPB.

Methods:
Thirty-two children (2.2±1.1 years) with ventricular septal defect undergoing CPB were randomized into two groups to receive either inhaled sevoflurane (Group S) or intramuscular ketamine (Group K) for basal anesthesia. After basal anesthesia, all children were inducted by combined intravenous anesthetics and then intubation. Hemodynamic data were monitored by PRAM including heart rate (HR), systolic, diastolic and mean arterial pressure, stroke volume index (SVI), cardiac index (CI), systemic vascular resistances index (SVRI), the maximal slope of systolic upstroke (dp/dt\text{max}) after basal anesthesia, 1, 2, 5 min after combined intravenous anesthetics, and 1, 2, 5 and 10 min after intubation. Rate-pressure product (RPP) and cardiac power output (CPO) were calculated using standard equations.

Results:
HR, arterial pressures showed a significant decrease during induction (p<0.05), then a small and significant increase at intubation (P<0.0001), followed by a gradual decrease (p<0.0001) in both groups. As compared to Group S, in Group K, the decreases in arterial pressures during induction were significantly faster (p<0.01). Group K had significantly higher HR, arterial pressures, SVRI, dp/dt\text{max}, RPP and CPO and lower SVI (p <0.01) during the entire study period. CI was not significantly different (p>0.05). For each increase in CPO, RPP was significantly greater in Group K (p<0.0001).

Conclusions:
Compared with sevoflurane, ketamine exerts highly unstable and significant adverse effects on systemic hemodynamics and myocardial energetics during the basal anesthesia in children undergoing CPB. Further studies are warranted to examine the advantageous and disadvantageous effects of various anesthetic agents on systemic hemodynamics in neonates and infants with complex congenital heart diseases during CPB.