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Dexmedetomidine, Pediatric intravenous general anesthesia, Quality, Stress, Mean arterial pressure

TO ASSESS THE EFFICACY OF DEXMEDETOMIDINE IN PEDIATRIC INTRAVENOUS GENERAL ANESTHESIA.

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ABSTRACT

Introduction -Surgical anesthesia in children is characterized by low stability of the blood circulation system & triggering intense stress response, affecting the quality of anesthesia. Nowadays the IV general anesthesia without tracheal intubation before the start of surgery are very commonly seen. So the requirements increase for pediatric anesthesia. It is of clinical implication to improve the quality of intravenous general anesthesia without tracheal intubation to ensure perioperative safety in children, reduce the stress response, and reduce restlessness and pain during the recovery period. **Aim and Objective:** To assess the efficacy of dexmedetomidine in pediatric intravenous general anesthesia. **Methodology**: 100 children of age group 2 to 8 years having I-II grade of the American Society of Anesthesiologists (ASA) were recruited for the study. Random allocation of children in cases (50) and controls (50) was done. For children in the observation group, an intravenous infusion of dexmedetomidine was administered at 1.0 μg/kg within 10 minutes after initiation of intravenous anesthesia. In contrast, those in the control group received equal doses of normal saline instead of dexmedetomidine. All statistical data were processed using SPSS software. **Results:**There was no significant difference in age, sex, weight, operative time of cases and controls at baseline. Values of HR and MAP of children at different time points had no significant difference. **Conclusion:** Dexmedetomidine use in intravenous general anesthesia without tracheal intubation in children helps in stability of blood circulation and also reduced stress response and pain during the recovery period.

INTRODUCTION

Surgical anesthesia in children is characterized by low stability of the blood circulation system & triggering intense stress response, affecting the quality of anesthesia. 2,3 Nowadays the IV general anesthesia without tracheal intubation before the start of surgery are very commonly seen. So the requirements increase for pediatric anesthesia. It is of clinical implication to improve the quality of intravenous general anesthesia without tracheal intubation to ensure perioperative safety in children, reduce the stress response, and reduce restlessness and pain during the recovery period. Currently, agents used for intravenous general anesthesia without tracheal intubation in children primarily include sevoflurane, ketamine, and propofol [4]. Sevoflurane-related pediatric postoperative restlessness is more common 5. Ketamine has side effects such as restlessness, delirium, hallucinations, increased secretion, and potential neurotoxicity [6,7]. The use of propofol in intravenous general anesthesia without tracheal intubation in children is associated with high incidence of circulatory and respiratory depression and glossocoma, as well as reduced safety [8].

So these agents are not effective as they affect the quality and safety of pediatric anesthesia. Dexmedetomidine is a highly selective α2-adrenergic receptor agonist that has anti-sympathetic, sedative, analgesic, and anxiolytic effects, causing minimal circulatory and respiratory depression [10,11]. It is observed in various studies that dexmedetomidine administered in combination with the mentioned sedatives & used in all stages of general anesthesia with endotracheal intubation. The sedation produced is good, less stress, also decreased use of intraoperative agents while maintaining hemodynamic stability and less respiratory depression [11]. Nevertheless, few reports have been concerned with the use of dexmedetomidine in intravenous general anesthesia without tracheal intubation in children. So we have conducted this study to assess the efficacy of dexmedetomidine in pediatric intravenous general anesthesia.

MATERIALS AND METHODS

Data was collected from previous year between April 2018 to April 2019. 100 children were recruited for the study. Age group was between 2 to 8 years having I-II grade of the American Society of Anesthesiologists (ASA). Random allocation of children in cases (50) and controls (50) was done. No surgical contraindications, were seen and the children and their families actively cooperated. Children were excluded if they were accompanied by multiple organ dysfunction syndrome involving the heart, lung, liver, and kidneys; if they were allergic to anesthetics (propofol, midazolam, and dexmedetomidine); if they had a respiratory tract infection within one month before surgery; if they had no central nervous system disease or had not administered sedatives, analgesics, or anesthetics in recent years. All family members of the children recruited into this study submitted written informed consent.

Children in both the observation group and control group received intravenous general anesthesia without tracheal intubation. Upon entering the operating room, each child was given an oxygen mask and was monitored for vital signs. Intravenous access was established and oxygen was given. For all children in both groups, initially, an intravenous infusion of midazolam was administered at 0.1 mg/kg and propofol at 2-3 mg/kg. Afterward, intravenous pump infusion of propofol was administered at 1-2 mg/ kg/h to maintain anesthesia, followed by intravenous infusion of fentanyl at 1.0 μg/kg. Lactated Ringer's solution was injected to supplement physiological needs and losses in the intraoperative period. For children in the observation group, an intravenous infusion of dexmedetomidine was administered at 1.0 μg/kg within 10 minutes after initiation of intravenous anesthesia. When complete, an intravenous pump infusion of dexmedetomidine at 1.0 μg/ kg/h and then propofol at 1-2 mg/kg per hour were given to maintain anesthesia. In contrast, those in the control group received equal doses of normal saline instead of dexmedetomidine.

All statistical data were processed using SPSS software. Measurement data with normal distribution are described as mean ± standard deviation. P<0.05 was deemed as statistically significant.

Results

There was no significant difference in age, sex, weight, operative time of cases and controls at baseline (P>0.05). Time for leaving post anesthesia care unit and awakening time of children had no significant difference between the two groups (both P>0.05) Pediatric anesthesia emergence delirium scores of children in the observation group were significantly reduced compared to the control group. Adverse events of children, rates of pain and restlessness in the recovery period in the observation group were significantly lower than the control group. Values of HR and MAP of children at different time points had no significant difference.

Table 1- Baseline characteristics of children

	Control	Case
Number	50	50
Male	32	28
Female	18	22
Mean age	4.21 years	4.11 years
Mean weight	29.12 kg	30.1 kg
ASA I/II	21/29	24/26
Operation time	39.23 min	41.16 min

Table 2- Adverse events while in recovery

	Control	Case
Number	50	50
Pain	15	4
Restlessness	5	9
Vomiting	1	3
Bradycardia	6	10
Hypotension	11	11

Table 3- Heart rate of children

Heart rate (time/min)	Control	Case
Before Injection	109.12	108.67
After 10 min	124.5	114.84
After 20 min	135.3	116.69
After 30 min	133.11	128.11
At the end of surgery	115.46	112.59

Table 4- MAP of children

MAP (mm Hg)	Control	Case
Before Injection	71.53	74.12
After 10 min	75.23	71.59
After 20 min	65.35	69.26
After 30 min	62.25	64.11
At the end of surgery	64.50	67.12

DISCUSSION

Various factors, including surgical trauma and stress response, affect the quality of intravenous general anesthesia without tracheal intubation in children [12]. Children undergoing surgery show characteristics of low tolerance to surgical anesthesia and fluctuating hemodynamics during anesthesia 13. In clinical practice, tracheal intubation is frequently performed during operations due to severe hypoxemia induced by improper depth of sedation or the body's stress response. Dexmedetomidine is a highly selective 2-adrenergic receptor agonist that specifically exerts multiple effects (sedation, analgesia, stress relief, and inflammatory response). It is considered an ideal anesthetic adjuvant for stress relief and hemodynamic stabilization [14,15]. Children with intravenous general anesthesia without tracheal intubation are often associated with diverse degrees of physiological disorders and pathological changes. The results of this current study demonstrated that HR values of children in the control group presented a rapidly increasing trend, but MAP values showed a decreasing trend during anesthesia. HR values were remarkably lower but MAP values were considerably higher in the observation group than control group (all P<0.05). These results suggest that intravenous infusion and maintenance of dexmedetomidine helps stabilize hemodynamics in children. This could be due to the fact that dexmedetomidine can reduce excitability of sympathetic nerves, induce slower heart rates, activate 2-receptors in peripheral vascular smooth muscle cells, and give rise to vasoconstriction and elevated blood pressure. It has positive effects on suppressing HR and enhancing MAP. Pain in the recovery period is common adverse reactions to intravenous general anesthesia in children, possibly causing physical injury and threatening the lives of children, if severe [16,17]. Regarding adverse effects, the results of the present study exhibited no significant differences in vomiting, bradycardia, and hypotension between the two groups. Incidence of pain, however, were remarkably lower in the cases than control, suggesting that dexmedetomidine can significantly reduce incidence of pain for children in the recovery period.

CONCLUSION

Dexmedetomidine use in intravenous general anesthesia without tracheal intubation in children helps in stability of blood circulation and also reduced stress response and pain during the recovery period. It is also safer to use. In future trials it is required to assess the effectiveness of dexmedetomidine at different doses.

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