Anaesthesia with and without dexmedetomidine for a child with multiple congenital anomalies posted for bilateral cataract extraction

INTRODUCTION

Incidence of congenital cardiac defects with eye involvement could be as high as 95%. Dexmedetomidine is an α_2-receptor agonist, which can be a useful adjuvant in paediatric cardiac anaesthesia.[1] Besides its favourable sedative and anxiolytic properties it attenuates haemodynamic and neuroendocrine responses to surgical trauma. Use of dexmedetomidine in ophthalmic surgeries for its reducing effect on intraocular pressure (IOP) is also well-documented.[2] In this baby, effects of

dexmedetomidine premedication on the dose of anaesthetics, intra-operative haemodynamic, and IOP were studied and compared in both surgeries.

CASE REPORT

A 5-month-old, 3.67 kg, male baby presented with bilateral mature congenital cataracts and was posted for sequential bilateral eye lens excision and anterior vitrectomy under general anaesthesia.

The baby was delivered as a full-term baby by normal delivery and his low birth weight (1.8 kg), fever, jaundice with hepatosplenomegaly necessitated neonatal intensive care unit (ICU) admission for 15 days. He was investigated for congenital rubella syndrome, but serology was not supportive. Atrial septal defect (ASD) was identified preoperatively by clinical examination and echocardiography. Echocardiography revealed mild pulmonary hypertension with, secundum type of ASD (4 mm) with left to right flow. Baby had right sided cleft lip and palate, bilateral mature cataracts, no signs of cyanosis, and infection or congestive cardiac failure. The baby had normal heart rate (HR) (140/min, regular) and respiratory rate (40/min) maintaining good oxygen saturation (99%) on room air. However, icterus was evident.

Lungs were clear. An ejection systolic murmur was heard, which was most prominent over the pulmonary area of the precordium. On per abdominal examination, hepatosplenomegaly was palpable. The child was irritable, but neurologically normal.

His routine pre-operative haematological and biochemical investigations were normal. C reactive proteins were negative. However, high reticulocyte count (4.7%), with unconjugated hyperbilirubinemia (total 18.2 mg%, direct 3.1 mg%, indirect 15.1 mg%) was suggestive of pre-hepatic jaundice.[3]

X-ray chest depicted cardiomegaly with normal airway and lung fields. Electrocardiogram (ECG) revealed right axis deviation and incomplete right bundle branch block.

The child was kept nil by mouth for 4 h prior to the surgery. The child was pre-medicated with oral midazolam 1.5 mg 45 min before surgery and intravenous glycopyrrolate 15 μg 10 min before surgery.

In the operating room, monitoring included heart rate (HR), mean arterial pressure, pulse oximetry, ECG and end-tidal carbon dioxide monitoring ($EtCO_2$) carried out throughout both operations. While IOP was measured (using Schioetz tonometer) before and after giving pre-medication, before administration of succinylcholine, immediately after intubation, and then every 2 min for 6 min before starting both the surgeries.

Anaesthesia was induced with thiopentone sodium (20 mg, in two 10 mg doses) and suxamethonium (10 mg) was injected for muscle relaxation after ability to mask-ventilate the patient was confirmed. Intubation was achieved using No. 3 sized plain endotracheal tube. Pressure-controlled ventilation was used manually with 250 ml bag attached to Ayres T piece to maintain mild hypocarbia. Anaesthesia was maintained with oxygen, nitrous oxide (50:50) and sevoflurane (2-4%), and atracurium. Dextrose with 0.33% saline was infused at the rate of 2.5cc/min (total 150 cc) with the help of infusion pump. Patient was haemodynamically stable throughout the intra-operative period. At the end of surgery, neuromuscular blockade was reversed with neostigmine 0.2 mg and glycopyrrolate 30 μg. On recovery of vital reflexes, baby was extubated. Dexamethasone 0.5 mg was given intravenously before shifting the baby to paediatric ICU.

Post-operative course was uneventful except the emergence agitation, which was partially alleviated by tramadol suppository (12.5 mg) and presence of his mother in paediatric ICU.

He was rescheduled for surgery of the other eye after 10 days. Second time Dexmedetomidine 0.5 μg was given intravenously over 10 minutes in addition to other premedicants. Rest of the anaesthetic management was similar and uneventful.

For second surgery, there was 50% reduction in the dose of thiopentone sodium and concentration of sevoflurane required to keep adequate depth of anaesthesia was 3%. Maximum drop in HR was 10% of baseline during the first operation while it was 22% during the second operation. Succinylcholine and intubation increased IOP during both the operations. However, during the second operation, after premedication with dexmedetomidine, the IOP rise was not different from the baseline value (before premedication) and was significantly lower than that of the first surgery. After the second surgery, the child was awake, but quiet.

DISCUSSION

Intravenous induction with titrated doses of thiopentone was planned as exposure to higher concentrations of sevoflurane for induction may depress the myocardium and a delayed induction was anticipated due to left to right shunt through a large ASD.

In view of the presence of ASD, we maintained $EtCO_2$ at 32-38 mm Hg. Volatile anaesthetic induced reduction in systemic vascular resistance and increase in pulmonary vascular resistance (nitrous oxide) were attenuated by ventilation induced mild hypocarbia resulting in a decrease in the shunt fraction.[4] The perioperative infusion of dexmedetomidine decreases the incidence and frequency of emergence delirium in children after sevoflurane-based general anaesthesia.[5,6] To alleviate emergence agitation, we decided to use dexmedetomidine in premedication for the second surgery.

Various studies have reported that the pharmacokinetics of dexmedetomidine in children is predictable and consistent with results similar to that reported in adults. Given is dependence on hepatic metabolism, a prolonged half-life and delayed elimination has been noted in adults with hepatic dysfunction.[7] Our observations were consistent with a well-conducted randomised controlled trial in which after administration of dexmedetomidine (0.6 μg/kg) there was a significant reduction in IOP and sympatholysis in the dexmedetomidine group compared with patients treated with placebo.[8] This may be the first reported case evaluating the safety of use dexmedetomidine in a patient with pre-hepatic hyperbilirubinemia.

CONCLUSION

Our results imply that dexmedetomidine may be a useful anaesthetic adjuvant in a child with congenital heart defects for ophthalmic surgery. Dexmedetomidine as a premedicant is effective in preventing emergence agitation.

Jyotsna Satish Paranjpe, Divakar M Patil, Manohar Vilas Mane, Sunanda Pramod Bandgar

Department of Anesthesiology, Bharati Vidyapeeth Medical College and Hospital, Wanleswadi, Sangli, Maharashtra, India

Address for correspondence:
Dr. Jyotsna Satish Paranjpe,
'Dhanvantari' 36, Ekata Colony, Market Yard,
Sangli - 416 416, Maharashtra, India.
E-mail: san_jyotsna@yahoo.co.in

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