Reminder of important clinical lesson

Laparoscopic surgery in a paediatric patient with Down's syndrome and patent foramen ovale

Sarita Singh,¹ Reetu Verma,¹ Anand Pandey,² Chetna Tandon,¹ Ashish Wakhlu,² Aman Agarwal¹¹Department of Anesthesiology, CSMMU (formerly King George's Medical University), Lucknow, India;²Department of Pediatric Surgery, CSMMU (formerly King George's Medical University), Lucknow, India

Correspondence to Dr Anand Pandey, dranand27@rediffmail.com

Summary

The safety of laparoscopic surgery in infants with congenital heart disease has been a subject of controversy despite potential benefits over open surgery. The authors present the anaesthetic management of a 6-month-old female infant with Down's syndrome with a small patent foramen ovale with left to right shunt who successfully underwent laparoscopic coloplasty. There were no intraoperative or postoperative complications. In addition to the routine anaesthetic considerations for any surgical patient, the choice of the anaesthetic technique in patients undergoing laparoscopic procedures should consider the effect on the patient's underlying cardiorespiratory function of pneumoperitoneum and carbon dioxide insufflation.

CASE PRESENTATION

A 6-month-old female child having anorectal malformation was posted for laparoscopic coloplasty. Pelvic colostomy was performed when she was 2-days-old. She had history of cyanotic spells 1 month after her first surgery and was diagnosed to be have a patent foramen ovale (PFO). The patient also had history of recurrent chest infections. Her weight was 2.8 kg. Airway examination appeared to be normal. On cardiovascular examination, heart sounds were normal but a murmur was heard. The respiratory system was within normal limits and laboratory investigations were within normal limits. The 2D echocardiogram of the patient revealed small PFO with left to right shunt.

After taking informed consent, the patient was taken to theatre. The heart rate (HR) was 164/min, SpO₂ 100%, with normal temperature. Antibiotics were administered for endocarditis prophylaxis. The patient was premedicated with intravenous fentanyl (2 µg/kg) and atropine (0.01 mg/kg). Inhalational induction was performed with halothane, O₂ and N₂O. She was intubated with an endotracheal tube of internal diameter 4 mm and endotracheal CO₂ (ETCO₂) was connected. Intraoperatively, the patient was maintained on O₂, N₂O, isoflurane and atracurium (0.1 mg/kg). The concentration of isoflurane was titrated to haemodynamic parameters. The peritoneal cavity was insufflated with CO₂ at a maximum pressure of 8 mm Hg at flow of 1 l/min. She was placed at 30 degrees in the Trendelenburg position. Pressure controlled ventilation was used to prevent high peak inspiratory pressure and minute ventilation was increased to maintain normocarbida. Intraoperatively, the HR ranged between 164 and 210/min, SpO₂ 98–100%, and ETCO₂ 28–44 mm Hg. The patient was reversed with neostigmine (0.005 mg/kg) and atropine (0.01 mg/kg) and patient was extubated.

OUTCOME AND FOLLOW-UP

Postoperatively, the patient was taken to paediatric intensive care unit for monitoring. The postoperative course was uneventful.

DISCUSSION

Down's syndrome, also known as Trisomy 21, is one of the most common congenital anomalies, occurring in about 1 in 800–1000 live births.¹ Many organ systems may be involved in Down's syndrome, especially cardiovascular, respiratory and central nervous system (CNS), which may pose anaesthetic challenges. Down's syndrome patients have decreased CNS catecholamine levels which may result in decreased minimum alveolar concentration level.² Atropine hypersensitivity has been noted in these patients; hence, sensitivity to atropine needs to be evaluated before giving a vagolytic dose.³ Due to the presence of muscular hypotonia,¹ muscle relaxants need to be used with care.

Laparoscopic coloplasty was planned in this patient to decrease postoperative pulmonary dysfunction due to decreased operative time. This approach, with proper monitoring and postoperative ICU care, may be the preferred in this type of patients.⁴ The intra-arterial pressure (IAP) level is a major determinant of cardiorespiratory changes during laparoscopy. The cardiovascular response to increased IAP involves changes in preload, systemic vascular resistance and myocardial contractility.^{5–6} A study using trans-oesophageal echocardiography during paediatric laparoscopy has shown that cardiac index (CI) decreases approximately 13% at an IAP of 12 mm Hg in healthy children with no adverse effects at an IAP of 6 mm Hg.⁷ As decreased CI may reduce shunt flow, which may result in desaturation, a maximum IAP of 12 mm Hg has been recommended for patients with cardiac disease.⁸

The increase in IAP also affects respiratory function. In infants, a reduction of functional residual capacity (FRC)

due to pneumoperitoneum and raised IAP causes alveolar collapse, increased venous admixture and oxygen desaturation more rapidly than in adults.⁹ Prevention of atelectasis with an adequate tidal volume and positive end expiratory pressure preserves FRC.⁸ Inspired oxygen concentration should be the minimum necessary to achieve baseline oxygen saturation. Hyperoxia decreases peripheral vascular resistance leading to pulmonary over-circulation and decreased systemic perfusion. Absorption of CO₂ can be significant and an increase in minute ventilation is required to maintain normocarbida.^{10–12}

As our patient was a diagnosed case of Down's syndrome, we anticipated a difficult intubation and planned for inhalational induction. As subglottic stenosis is well reported in these patients,¹³ we used an endotracheal tube 0.5 mm diameter smaller than the standard age appropriate endotracheal tube size. Atlantoaxial instability has been reported in 20% of patients with spinal cord compression in 2%, so we kept the head and neck in neutral position.^{14 15} Intraoperative hypothermia, hypercarbia and hypoxemia are known to cause shunt reversal. These were avoided by detailed monitoring of the patient.

Learning points

- ▶ Intubation in patient of Down's syndrome can be difficult due to subglottic stenosis, large tongue and sensitivity to atropine, hence, extra vigilance is important.
- ▶ Cardiac lesions may make anaesthesia challenging.
- ▶ Muscular hypotonia means care must be taken when using muscle relaxants.
- ▶ Capnography is important to assess the effect of pneumoperitoneum.

Competing interests None.

Patient consent Obtained.

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