Pediatric Anesthesia

Case report: sugammadex used to successfully reverse vecuronium-induced neuromuscular blockade in a 7-month-old infant

Sir—We would like to present a case report of sugammadex used successfully in a failed intubation scenario involving an infant weighing 6 kg.

A 7-month-old child weighing 6 kg was listed for elective cleft palate repair. She had Pierre Robin sequence with a hypoplastic left mandible. Difficult intubation was predicted. Two specialist anesthetists were involved in her management.

The planned approach was to perform inhalational induction with sevoflurane. If mask ventilation was possible, an attempt at direct laryngoscopy would be performed, initially with a Miller size 0 blade, then to use a Benjamin Holinger Tucker (BHT) anterior commissure laryngoscope for intubation. If this technique proved unsuccessful, the backup plan was to perform fiber-optic laryngoscopy and intubation. A selection of pediatric difficult airway equipment was prepared.

Inhalational induction was achieved with sevoflurane, nitrous oxide, and oxygen. Venous access was obtained after induction. Mask ventilation was awkward but achieved so 0.7 mg of vecuronium was given. After 2 min, laryngoscopy was attempted, and a grade 4 view was obtained. The child showed some movement during laryngoscopy, so a further 0.3 mg of vecuronium was administered. Using a BHT laryngoscope, a second attempt at laryngoscopy was performed. The view was generally poor, and the larynx could not be clearly visualized. There appeared to be a polyp on the lateral wall of the pharynx obscuring the view. An attempt at intubation was unsuccessful.

A return was made to mask ventilation while the fiber-optic scope was prepared. On the first attempt, no view of the larynx could be obtained. On the second attempt, a view of the larynx was obtained but the endotracheal tube could not be passed as it was insufficiently lubricated. The field was noted to be bloody at this stage.

Mask ventilation was becoming more difficult with an extended period of mask ventilation expected. It was now 15 min since induction. A discussion took place about the potential role of sugammadex. It was decided to administer 4 $mg \cdot kg^{-1}$ in the first instance, with the option to increase the dose if required. Twenty-five milligram of sugammadex was administered intravenously, with very rapid return of airway tone and strong respiratory effort. After approximately 1 min, the child was able to breathe adequately without airway adjuncts. The operation was postponed. Tracheostomy was not proposed at this stage since the airway was already threatened and consent for tracheostomy had not been sought.

Discussion

Our plan included the use of muscle relaxation to improve the chance of successful intubation, and hence limit the number of attempts, and to reduce the risk of laryngospasm in a spontaneously breathing patient with a topicalized airway.

In this circumstance, it was felt that further attempts to intubate would be unsuccessful and probably harmful, and that the case should be abandoned. We believe the increased difficulty of mask ventilation was caused by edema provoked by instrumentation of the airway.

For the next attempted operation, an elective tracheostomy will be performed. Even if intubation is successful and cleft palate repair proceeds, the child would be impossible to reintubate as an emergency, in the event of a failed elective extubation or an accidental extubation following the operation. In addition, the child has demonstrated low oxygen saturations at night and a tracheostomy may reduce the risk of chronic hypoxia and subsequent developmental delay issues.

The manufacturer currently recommends that, for lack of safety data, sugammadex should not be used in infants under 2 years of age, although some studies in infants have been reported (1). Our experience of using sugammadex was limited at that time to adult patients having received rocuronium, although we felt that the risk of prolonged and difficult mask ventilation justified its use in this case.

Learning points:

1. Sugammadex is effective in reversal of neuromuscular blockade with either vecuronium or rocuronium.
2. Sugammadex has been used effectively and safely in the infant age group.
3. Sugammadex should be considered when faced with the 'can't intubate, can't ventilate' scenario in the pediatric population.

Conflicts of interest

Neither author has any involvement, financial or otherwise, with the manufacturers of sugammadex. No funding or sponsorship was sought or provided from any source. Written parental consent was obtained having shown the parents the full text of the report.

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Reference

1 Plaud B, Meretoja O, Hofmockel R *et al*. Reversal of rocuronium-induced neuromuscular blockade with sugammadex in pediatric and adult surgical patients. *Anesthesiology* 2009; **110**: 284–294.

The transversus abdominis plane (TAP) block in neonates and infants – results of an audit

Sir—Good perioperative analgesia for abdominal surgery in neonates and infants is difficult to obtain when epidural analgesia is contraindicated or when consent for neuroaxial block is not given. The transversus abdominis plane (TAP) block was originally described as a landmark technique (1). An ultrasound guided approach was subsequently described by Hebbard *et al*. (2), and this technique has been successfully applied to children for supplementing analgesia for abdominal surgery (3, 4).

We audited the quality and duration of analgesia following a TAP block in five neonates and five infants having had abdominal surgery. The audit was approved by our local audit department (Reg: BCH AN86/2010). We are well aware of the limitations of such a case series, but considering the lack of evidence available on the topic, we believe our results warrant dissemination. We recognize the call for a RCT on patient outcome following TAP blocks in children.

The TAP blocks were placed after induction of general anesthesia, which was induced with sevoflurane, followed by cisatracurium, atracurium or rocuronium for intubation. In Case 6, a rapid sequence induction was performed with propofol and suxamethonium (see Table 1).

The TAP was identified using a 'hockey stick' ultrasound probe (SLA 25 mm broadband linear array Sonosite MicroMaxx, Bothell, WA, USA). A two inch 19 gauge needle was used to inject 1 $ml \cdot kg^{-1}$ of 0.25% levobupivacaine (Abbott, Maidenhead, UK) under realtime ultrasound imaging. To avoid peritoneal perforation, the needle was advanced under continuous ultrasound guidance at an angle of 10–20^{o} to the ultrasound probe, this ensured good visibility of the needle tip at all times.

The level of the block was tailored to the dermatomal area of analgesia required by the surgical incision. For incisions above the umbilicus, we followed the subcostal oblique approach with hydrodissection as described by Hebbard (5). For subumbilical surgery, the TAP block was sited more laterally at the T9-10 dermatome (1). In two cases, the surgical incision required bilateral TAP blocks in which case 0.5 $ml \cdot kg^{-1}$ of 0.25% levobupivacaine was injected on each side.

Intraoperative and postoperative analgesic regimes varied between anesthetists; two were prescribing a morphine infusion as nurse-controlled analgesia (NCA) irrespective of the quality of intraoperative analgesia provided by the TAP block (Cases 8 and 10).

Data collected included hemodynamic response (heart rate and blood pressure) to surgical incision and surgical stimulation, and intraoperative opioid requirement. Patients were followed up for 24 h postoperatively. Hourly postoperative pain assessment was carried out with the Neonatal Infant Pain Scale (6) (NIPS), and total analgesic requirement for the first 24 h postoperatively was recorded. For results, please refer to Table 1.

Seven of ten patients did not require intravenous opioids. Eight of ten patients had maximum NIPS scores of zero or one during the first 24 h post surgery.

In our series of ten neonates and infants presenting for abdominal surgery, TAP block provided effective intra-operative analgesia with the majority of patients