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Respiratory depression after low-dose caudal morphine

Purpose: To report a case of respiratory depression after a small dose of caudal morphine administered to a 15-mo-old child.

Clinical features: A 15 mo, 9.8 kg boy underwent ureteral reimplantation with general endotracheal anaesthesia and 10 ml bupivacaine 0.25% ($2.5 \text{ mg} \cdot \text{kg}^{-1}$). Ninety minutes after the bupivacaine, 0.4 mg ($1 \text{ mg} \cdot \text{ml}^{-1}$, 0.4 ml, $0.04 \text{ mg} \cdot \text{kg}^{-1}$) preservative-free morphine was injected after negative aspiration. Slightly more than two hours after caudal morphine, the patient became lethargic and developed decreases in oxygen saturation (to 62%) without change in heart rate or respiratory rate. Intravenous naloxone 0.1 mg ($0.01 \text{ mg} \cdot \text{kg}^{-1}$) markedly improved his level of consciousness. Racemic epinephrine was administered for treatment of coincident stridor. The patient required 11 hr continuous naloxone infusion ($0.001\text{--}0.002 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{hr}^{-1}$) in the intensive care unit. He was discharged on the second postoperative day without further complication.

Conclusion: Respiratory depression can occur in children greater than one year of age, even when small doses of caudal morphine are used. Decreased arterial oxygen saturation and lethargy are important heralds. A normal respiratory rate despite substantial hypoxaemia argues that pulse oximetry (without supplemental oxygen where possible) has a clear advantage over impedance pneumography for electronic monitoring.

Key words

ANAESTHESIA: complications;
ANAESTHESIA: pediatric;
ANAESTHETIC TECHNIQUES: regional, caudal;
OPIOIDS: pain management, postoperative

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Objectif: Présenter un cas de dépression respiratoire consécutive à l'injection caudale d'une petite dose de morphine.

Éléments cliniques: Un jeune garçon âgé de 15 mois était opéré pour une réimplantation urétérale sous anesthésie générale endotrachéale combinée à de la bupivacaine 0,25% 10 ml ($2,5 \text{ mg} \cdot \text{kg}^{-1}$). Quarante-vingt-dix minutes après la bupivacaine, de la morphine 0,4 mg ($1 \text{ mg} \cdot \text{ml}^{-1}$, 0,4 ml, $0,04 \text{ mg} \cdot \text{kg}^{-1}$) était injectée après un test d'aspiration négatif. Un peu plus de deux heures après l'administration caudale de morphine, le patient devenait léthargique et sa saturation en oxygène diminuait (à 62%) sans que sa fréquence cardiaque et respiratoire n'ait changé. L'injection intraveineuse de naloxone 0,1 mg ($0,01 \text{ mg} \cdot \text{kg}^{-1}$) améliorait considérablement son niveau de conscience. De l'épinéphrine racémique était aussi administrée pour traiter un stridor surajouté. Le patient a eu besoin d'une perfusion continue de naloxone ($0,001\text{--}0,002 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{h}^{-1}$) pendant 12 heures à l'unité des soins intensifs. Il était libéré deux jours après l'opération sans autres complications.

Conclusion: Une dépression respiratoire peut survenir chez des enfants de plus d'un an, même lorsque les doses de morphine administrées sont minimes. La baisse de la saturation en oxygène et la léthargie constituent des signes importants. Le maintien d'une fréquence respiratoire normale malgré une hypoxémie importante plaide en faveur de l'oxymétrie de pouls (à l'air ambiant lorsque c'est possible) comme moniteur électronique préférablement à la pneumographie par impédance.

Clinically important, delayed, respiratory depression in paediatric patients after neuraxial opioids¹⁻³ has been described only with concomitant systemic opioids and/or epidural morphine doses $>0.05 \text{ mg} \cdot \text{kg}^{-1}$,^{1,2} or in infants <eight months.² We report a case of respiratory depression after a small dose of caudal morphine administered to a 15-mo-old child.

Case report

A 15 mo, 9.8 kg boy was scheduled for ureteral reimplantation. He had had an uncomplicated general anaesthetic two weeks previously. The only history of note was that he frequently snored at night.

The patient received no premedication. Anaesthesia

was induced with thiopentone, and tracheal intubation was facilitated with vecuronium. A 4.0 mm I.D. endotracheal tube allowed a gas leak <10 cm H₂O. It was changed to a 4.5 mm I.D. tube which allowed no gas leak; therefore the 4.0 mm endotracheal tube was replaced. An 18 G intravenous catheter (Terumo, Elkton MD) was placed in the caudal epidural space. A 20-gauge open tip epidural catheter (Burrin, Bethlehem PA) was threaded through the intravenous catheter without resistance and taped at 8 cm. Aspiration was negative, and a test dose of 1 ml of bupivacaine 0.25% with 5 µg·ml⁻¹ epinephrine did not change heart rate. Surgery was performed under an additional 9 ml of the above solution and halothane (inspired 0.2–0.3%) in N₂O 70% and O₂. Ninety minutes after the bupivacaine, 0.4 mg (0.04 mg·kg⁻¹) undiluted preservative-free morphine (1 mg·ml⁻¹, 0.4 ml) was injected after negative aspiration using a 1 ml syringe. The injection was followed by an equal volume of preservative-free saline. The surgical procedure was completed 30 min later and, after one hour in the post-anaesthesia care unit (PACU), he was transferred to a surgical nursing unit. At that time, the patient was awake, his arterial oxygen saturation by pulse oximetry (SpO₂) was 97% while breathing room air and good leg movement had returned. Ward monitoring included a pulse oximeter (alarms: SpO₂ <92%, heart rate <70 beats·min⁻¹). Oxygen, delivery device with mask, suction and naloxone were available at the bedside.

Forty minutes after transfer (2.2 hr after caudal morphine), the patient developed decreases in oxygen saturation as low as 62% without change in heart rate (100–142 bpm) or respiratory rate (20–28 breaths·min⁻¹). No analgesics or sedatives other than those listed above had been administered. The patient's heart rate on auscultation correlated with that on the pulse oximeter. He became lethargic and had mild stridor. No other analgesics or sedatives had been administered. Oxygen and chin lift raised the oxygen saturation to 100%. Racemic epinephrine was administered for treatment of suspected subglottic oedema. Naloxone 0.1 mg (0.01 mg·kg⁻¹ *iv*) markedly improved his level of consciousness. The patient was transferred to the intensive care unit, an additional 0.05 mg (0.005 mg·kg⁻¹) of naloxone was given 2.5 hr later, followed by 11 hr continuous infusion (0.001–0.002 mg·kg⁻¹·hr⁻¹). A second nebulized racemic epinephrine treatment was required.

The next morning, the patient returned to the surgical nursing unit and he was discharged home the following day. In addition to the single dose of caudal morphine administered in the operating room, the only analgesics the child required were four doses of ketorolac *iv* and two doses of oxycodone *po* with acetaminophen.

Discussion

This child's clinical course illustrates that respiratory depression can occur in children greater than one year of age, even when small doses of caudal morphine are used.

One question that arises after an unexpected response to medication injected via the epidural route is whether the catheter tip was in the appropriate place. If it had been in the subarachnoid space, one would expect a profound sensory and motor block after 2.5 mg·kg⁻¹ bupivacaine.⁴ This was not observed. A radiographic study using 1 ml of a non-ionic contrast agent such as Omnipaque® could have been used to confirm epidural catheter placement.

This patient's recovery was further complicated by mild laryngeal oedema (more likely after multiple intubations⁵) and airway obstruction from pre-existing presumed adenotonsillar hypertrophy. Habitual snoring in the 12–15 month age group is not uncommon: of one group of toddlers (mean age 42.2 mo) reported to "snore every night," more than half began to snore before their first birthday.⁶ Chronic upper airway obstruction (and perhaps occult sleep apnoea) is a risk factor for postoperative respiratory depression. The potential aggravation of the opioid-induced hypoventilation by pre-existing soft tissue hypertrophy emphasizes the importance of eliciting this history preoperatively.

The choice of patient monitoring after epidural opioids is poorly defined. Some healthy adults are monitored only as part of the nursing protocol.⁷ Because respiratory depression in children who receive epidural opioids without supplemental *iv* sedation is rare,³ some suggest that monitoring with pulse oximetry is unnecessary. This case illustrates the potential danger of not monitoring arterial oxygen saturation: the first sign of respiratory compromise was decreased oxygen saturation, not bradycardia or bradypnea. Clearly, provision must be made for continuous attention to the device's alarm by personnel in an intensive care unit, a central attended nursing station around which patient rooms are arranged as is the case in our hospital, or by telemetry.

Because this child's respiratory depression persisted for many hours, because others have reported the onset of respiratory depression as late as 11.5 hr after caudal morphine administration,² and because CO₂ response curves are still depressed by epidural morphine at 22 hr,⁸ we advocate pulse oximetry for at least 18 hr after a single dose of epidural morphine, as has been recommended for intrathecal morphine.⁹ As long as oxygen saturation is in an acceptable range (>92%), the patient should be breathing room air in order to avoid obscuring the diagnosis of hypoventilation.

In summary, life-threatening hypoxaemia in a child

over one year of age after $0.04 \text{ mg} \cdot \text{kg}^{-1}$ epidural morphine emphasizes the importance careful monitoring of paediatric patients after epidural opioids. Decreased arterial oxygen saturation and lethargy are important heralds of severe respiratory depression. This child's responsiveness to naloxone indicates that the hypoventilation was primarily opioid-related; however, other factors (mild tracheal oedema in the setting of chronic upper airway obstruction during sleep) may have contributed. A normal respiratory rate despite substantial hypoxaemia argues that pulse oximetry (without supplemental oxygen where possible) has a clear advantage over impedance pneumography for electronic monitoring.

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