Brief Reports

Benign hyperthermia following prolonged TIVA with propofol

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Purpose: Propofol is widely used for general anesthesia because of its rapid onset and recovery. We had four cases that had higher body temperatures toward the end of anesthesia. The etiology of the hyperthermia is discussed.

Clinical features: Four patients (three male, one female, 22-26 yr of age, weighing 53-57 kg) with facial deformities were anesthetized with propofol infusion ($3-10 \text{ mg}\cdot\text{kg}^{-1}\cdot\text{hr}^{-1}$) and fentanyl ($400-1,300 \mu\text{g}$) without nitrous oxide, immobilized with vecuronium bromide (18-37 mg) or pancuronium bromide (31 mg). In order to reduce blood loss and improve the surgical view, tri-nitro-glycerin (TNG) was used in all cases. Osteotomy of maxilla and mandible or sagittal split ramus osteotomy of mandible was successfully performed. Although their body temperatures were normal preoperatively and stable during the operation, toward the end of anesthesia (one hour), they increased to over 38°C . The room temperature was decreased and the water blanket on the operating table was also decreased. In addition, cool crystalloid solution was infused. Body temperature returned to normal in the ward and no complications due to the high temperature were seen postoperatively. It is thought that lighter anesthesia was masked by continuous infusion of propofol and TNG-induced hypotension and that benign hyperthermia occurred toward the end of anesthesia.

Conclusion: Propofol reduces blood pressure, which suggests deep anesthesia. However, care must be taken to maintain the optimum depth of anesthesia during propofol anesthesia, especially when deliberate hypotensive anesthesia is induced.

Objectif : L'usage du propofol est répandu en anesthésie générale, car il présente un début d'action et une récupération rapides. Nous décrivons quatre cas d'hyperthermie survenue vers la fin de l'anesthésie. Les causes de l'hyperthermie sont examinées.

Éléments cliniques : Quatre patients (trois hommes, une femme, de 22-26 ans, de 53-57 kg) présentant des malformations faciales ont été anesthésiés avec une perfusion de propofol ($3-10 \text{ mg}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$) et du fentanyl ($400-1\,300 \mu\text{g}$) sans protoxyde d'azote. Le bromure de vécuronium (18-37 mg) ou de pancuronium (31 mg) a servi au relâchement musculaire. Dans le but de réduire la perte sanguine et d'améliorer la vision du champ, la trinitroglycérine (TNG) a été utilisée dans tous les cas. L'ostéotomie du maxillaire et de la mandibule ou l'ostéotomie de la branche divisée sagittale ont été réalisées avec succès. Même si la température du corps était normale avant l'opération, et stable pendant l'opération, elle a monté jusqu'à plus de 38°C vers la fin de l'intervention (une heure). La température de la salle a été abaissée de même que celle du matelas réfrigérant de la table d'opération. De plus, on a perfusé un soluté refroidi de cristalloïde. La température corporelle est revenue à la normale et on n'a observé aucune complication postopératoire reliée à l'hyperthermie. On a pensé que l'anesthésie légère a été masquée par la perfusion continue de propofol et l'hypotension induite par la TNG et que l'hyperthermie bénigne a pu ainsi survenir vers la fin de l'anesthésie.

Conclusion : Le propofol réduit la tension artérielle, ce qui est le signe d'une anesthésie profonde. Toutefois, il faut prendre soin de maintenir une profondeur d'anesthésie optimale pendant l'utilisation du propofol, surtout quand l'anesthésie hypotensive est délibérément induite.

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As a core intravenous anesthetic, propofol has been widely employed for Total Intravenous Anesthesia (TIVA). Since hypotensive anesthesia is useful during osteotomy of the maxilla and mandible, we have employed TIVA using propofol combined with hypotensive anesthesia.

During one year we experienced four cases of hyperthermia postoperatively after TIVA using propofol with hypotensive anesthesia by tri-nitro-glycerin (TNG).

Case reports

Case #1

General anesthesia was scheduled for osteotomy of maxilla and mandible of a 24-yr, 55 kg, woman with facial deformity. Prior to anesthesia, her vital signs were stable, including axillary temperature which was 35.8°C. Anesthesia was induced with 110 mg propofol and 50 µg fentanyl; 16 mg vecuronium bromide was given to facilitate nasotracheal intubation. Rectal temperature was 36.4°C at the beginning of operation. Anesthesia was maintained with continuous infusion of propofol (3-8 mg·kg⁻¹·hr⁻¹, total 4,112 mg) and intermittent boluses of fentanyl (total: 600 µg). During osteotomy TNG was administered to reduce blood pressure to 80/40 mmHg. The hypotension lasted 3 hr 25 min and surgical duration was 9 hr 21 min. Total blood loss was 952 g and 1,200 ml whole blood was administered. Sixty minutes before the end of surgery, her rectal temperature increased to 38°C and continued to increase to the end of anesthesia (Figure). Maximum temperature was 38.3°C. Shivering, tremor, muscle rigidity, excitement and other abnormal signs were not observed.

Case #2

Osteotomy of the mandible was performed on a 22-yr-old male (55 kg) because of facial deformity. Preanesthetic axillary temperature was 36.3°C. The anesthetic sequence with TIVA and NTG was similar to Case #1. The first rectal temperature was 36.2°C. Surgical duration was 4 hr 56 min. Total blood loss was 1,160 g and 800 ml of blood was transfused. Crystalloid, 3,220 ml, was infused continuously and total urine output was 2,705 ml. Immediately after surgery, the rectal temperature began to increase to 38°C. The room temperature was decreased, the temperature of the water blanket was decreased, and a cool infusion was started, although his temperature went up to 39.3°C (Figure). There was no shivering, no tremor, nor excitement. After the rectal temperature decreased to 38.7°C, his trachea was extubated and the patient was transferred to the ward.

FIGURE Changes of temperature of the four patients. Towards the end of the anesthesia the temperature increased to 38°C. Each arrow shows the end of each operation. None of the patients had any complication after anesthesia.

Case #3

A 26 yr, 57 kg male was anesthetized for osteotomy of mandible due to facial deformity. Preoperatively, axillary temperature was stable at 36.5°C. The first rectal temperature was 36.5°C. After a similar anesthetic technique with TIVA and NTG, blood loss was 537 g and 4,450 ml crystalloid and 800 ml blood were infused. Surgical duration was 8 hr 45 min. His rectal temperature was increasing during operation and after operation, up to 39°C (Figure). However, there were no symptoms of malignant hyperthermia such as tachycardia, muscle rigidity, or hypercapnea. The room temperature, temperature of the water blanket, that of infusion was adjusted to decrease the body temperature. Although the body temperature was still high (39.4°C), he was so stable that his trachea was extubated. Six hours after anesthesia, his axillary temperature was 37.3°C.

Case #4

Osteotomy of the maxilla and mandible was planned for facial deformity of 25-yr, 53 kg, healthy man using a similar anesthesia sequence of TIVA and TNG. Preoperatively, axillary body temperature was 36.0°C. At the beginning of operation, rectal temperature was 35.9°C. Surgery lasted 10 hr 40 min and 1,600 g of blood loss was estimated, therefore, 1,600 g of blood was transfused. Urine output was 4,166 g and 6,110 ml of crystalloid were infused. At the end of operation rectal temperature was 36.5°C. Duration of operation was 10 hr 40 min. During emergence from anesthesia, his rectal temperature increased to 38.5°C (Figure).

Furosemide, 10 mg *iv*, was given for urination. The other treatments including lowering the room temperature, reducing the temperature of water blanket, or giving cooler infusion were performed. Next morning his temperature had decreased to 37.4°C and no other complication was found.

Discussion

Continuous TIVA is commonly used to provide general anesthesia for oral surgery because of its rapid recovery. There have been no reports of hyperthermia using propofol and induced hypotension. Ueno *et al.* reported malignant hyperthermia after propofol and fentanyl anesthesia.¹ Hyperthermia in our cases was not malignant hyperthermia because there was no tachycardia, no hypercapnea, no acidosis and no muscle rigidity.² In another report of hyperthermia during propofol anesthesia³ the temperature was 37.9°C, but obvious cause was not found.

Postoperative hyperthermia may be due to shivering, malfunction of temperature control because of drug and surgery, atelectasis, infection, dehydration, malignant hyperthermia stress, or pain.⁴ From these, the likely causes of hyperthermia in our patients seem to be stress and pain, which was caused by light anesthesia; light anesthesia might be masked by hypotensive anesthesia by TNG. As propofol anesthesia reduces blood pressure, it may be difficult to detect anesthetic depth. Propofol anesthesia with a hypotensive agent may conceal the depth of general anesthesia because blood pressure is controlled by hypotensive anesthesia.

References

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