

# Does the type of Anesthesia Administered Affect Theefficacy of Medicinal Leech Therapy After Fingerreplantation: Clinical Observations in a 6-year-old boy

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## Does the type of anesthesia administered affect the efficacy of medicinal leech therapy after finger replantation: clinical observations in a 6-year-old boy

**SIR**—A surgical technique for the replantation and microvascular repair of amputated fingers has been previously described (1). Recently, medicinal leeches have been increasingly used for venous decongestion, which is a common problem after the replantation surgery. This method is based on reducing venous congestion by ‘blood-letting’ and on the antithrombotic properties of hirudin in leech saliva (1). Anesthetic management for the treatment with leeches in children has not been described until now.

We are presenting an adjuvant anesthetic management after a complete degloving injury and finger replantation in a 6-year-old child. A boy suffered a third and ring finger avulsion injury with whole-circumference soft tissue defects and fractures of phalanges with preserved tendons of flexor digitorum superficialis muscle. Fracture stabilization with Kirschner wires in proximal interphalangeal joints and reconstruction of ligaments was followed by microsurgical repair with one artery reconstruction under general sevoflurane anesthesia. Prophylactic antibiotic treatment with cefazolin, gentamycin, and metronidazole was started. Paracetamol 4 × 300 mg was given for postoperative analgesia achieving good pain control. As venous reconstruction was not accomplished, bleeding was promoted by systemic unfractionated heparin

3 × 1000 U, by dextran solution, and by leaving skin unsutured at laceration site (Figure S1).

On the postoperative day 2, bleeding at the replantation line decreased. Both fingers were cyanotic and had signs of venous congestion with capillary refill longer than 5 s (Figure S1). After parents’ permission was obtained, a wound toilette and application of leeches under general anesthesia was planned. Induction was with propofol 2 mg·kg<sup>-1</sup> and maintenance with sevoflurane (1.5–2.5 vol%) in O<sub>2</sub> : N<sub>2</sub>O 35 : 65% vol%. Despite repeated attempts to place leeches on the cyanotic replanted fingers, leeches consistently migrated toward patient’s healthy tissue or tried to attach to the surgeon’s hand through his gloves.

Sevoflurane and nitrous oxide were turned off. Total intravenous anesthesia using propofol infusion 0.1 mg·kg<sup>-1</sup>·min<sup>-1</sup> was started (2). The child’s lungs were ventilated with 100% oxygen and continuous positive airway pressure (CPAP) ventilation by a face mask. CPAP was set at 5 hPa (3.75 mmHg) to improve oxygenation of replanted fingers. After approximately 15 min, the fingers regained normal color. At that time, leeches attached to both the fingers smoothly and were left for 30 min under hyperoxygenation condition. At the end of the treatment, fingers had normal color and appeared much softer, the



**Figure 1** Improved oxygenation and enhanced bleeding with medicinal leeches (*Hirudo medicinalis*).

capillary refill improved, and bleeding became more pronounced (Figure 1). The wound toilette and application of leeches was repeated three times in intravenous propofol anesthesia with hyperoxygenation. The child's arm was immobilized with a splint.

Oxygen therapy was continued once a day when the child was awake until 4 weeks after trauma with 1 h spontaneous ventilation through a noninvasive face mask. A pressure in the breathing circuit (CPAP) was gradually increased during sessions to 3 hPa (2.25 mmHg).

The mean arterial oxygen ( $\text{PaO}_2$ ) achieved after 30 minutes of intravenous anesthesia was 59 kPa during assisted face mask ventilation, and 40–55 kPa (300–412 mmHg) during spontaneous breathing with CPAP between 3 and 5 hPa.

Owing to the well-known leeches' bacterial flora and their susceptibility to aminoglycosides, antibiotic therapy was continued for 2 weeks (3). Two days after antibiotic therapy was discontinued, the signs of infection were noted. The Kirschner wires were removed and *Pseudomonas putida* strain was cultured. This strain is unusual in our hospital environment and may be a component of the microflora from the body surface of leeches. Meropenem with amikacin were given for next 2 weeks. One month after the trauma, necrotic tissue detached spontaneously, the child's fingers were well perfused and had no signs of infection, and the child was discharged home with a good outcome (Figure S2).

The mechanism why leeches did not attach during anesthesia with volatile anesthetics is not clear. Cooper reported in his recent paper a list of anesthetics in vet-

erinary medicine. Isoflurane 5–10%, sevoflurane, halothane 5–10%, and carbon dioxide ( $\text{CO}_2$ ) 10–20% are presented as successful and safe anesthetic agents for the anesthesia of terrestrial invertebrates (4). He described how  $\text{CO}_2$  may be used 'to immobilize, examine, and swab leeches' (4), an effect well known as carbon dioxide narcosis (5). The concentration of  $\text{CO}_2$  in normal venous blood is 5% and may be much higher in hyperperfused cyanotic tissue of the replanted fingers. Additive effects of high  $\text{CO}_2$ , sevoflurane, and  $\text{N}_2\text{O}$  could immobilize and anesthetize leeches. But after hyperoxygenation when sevoflurane and  $\text{N}_2\text{O}$  were discontinued, the effect on leeches was not registered.

Although the leech therapy during the venous congestion phase after finger replantation was successfully carried out with propofol infusion  $0.1 \text{ mg}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$  and oxygenation, there is no definitive answer as to which mechanism resulted in improved leech acceptance. Further studies are needed to answer whether the leeches attached to the fingers because of the change from inhaled to IV agent or because of providing 100%  $\text{O}_2$  with CPAP.

#### Conflict of interest

No conflicts of interest declared.

#### Supporting Information

Additional supporting information may be found in the online version of this article:

**Figure S1** Cyanotic replanted fingers on the day after surgery.

**Figure S2** Restored circulation and minimized tissue defects after microsurgical repair followed by noninvasive continuous positive airway pressure oxygenation via face mask.

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## Does not topical airway lidocaine before endotracheal intubation decrease the risk of perioperative respiratory adverse events in children?

SIR—In an observational audit including 1000 pediatric patients undergoing general anesthesia with endotracheal intubation without neuromuscular blockade, Hamilton *et al.* (1) showed an increased rate of arterial desaturation in the period between induction of anesthesia and discharge from the post-anesthesia care unit in children receiving topical airway lidocaine (TAL) prior to intubation, when compared with those not receiving TAL. Furthermore, incidences of laryngospasm and cough trended to be higher in the TAL groups, though no significant difference among the three groups was achieved. In our view, however, there are several aspects of this study that need to be clarified and discussed.

First, in method, the authors did not provide the details of anesthesia induction, such as first dose of propofol, and administration timing of additional propofol and opioid in relation to the implement of the TAL. If anesthetic level is inadequate, coughing, airway closure and laryngospasm, common causes of arterial desaturation and hypoxemia during the period of anesthesia induction in children, can occur in response to irritation of the upper airway structures from oropharyngeal or nasopharyngeal airway, secretions, blood, airway suction, and laryngoscopy (2). We concern that this may be a main reason for higher trend of laryngospasm and cough in the children receiving the TAL, especially for children receiving airway lidocaine spray under direct laryngoscopy.

Second, this study was performed in children undergoing the diverse procedures including ENT, plastics, orthopedics, dental, and general surgery. However, the authors did not indicate if the three groups were comparable with respect to the types of surgery. It is reported that the highest incidence of laryngospasm is associated with procedures involving surgery and manipulations of the pharynx and larynx (3,4). Furthermore, both the

surgical sites and techniques are closely related to the severity of arterial desaturation and the incidence of hypoxemia during the early postoperative period (5,6). Thus, we believe that addressing this factor would further clarify the transparency of their findings.

Third, in method, we noted that following TAL, child was ventilated with a bag and mask for approximately 2 min prior to intubation. In the results, the authors did not provide the duration of surgery in the three groups. Although 2–4% lidocaine used in the airway mucosa begins to produce topical anesthesia in about 1 min, 3–5 min is usually required to achieve maximal effect (7). When 2–4% lidocaine solutions are used for airway topical anesthesia, moreover, clinically useful duration of action is only 30–60 min (8). Therefore, we consider that when evaluating the effects of the airway topical anesthesia on the respiratory adverse events during the periods of anesthesia induction and recovery, the onset time and duration of local anesthetic should be considered.

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