CASE REPORT

A simple solution to unexpected kinking of endotracheal tube

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ABSTRACT

We report a case of unexpected kinking of endotracheal (ET) tube in an infant who was being operated in supine position and positioned away from the anesthetist. The usual management mentioned in the literature was unsuccessful. So, a simple and unique solution that can be useful in unanticipated kinking of ET tube is described.

Key words: *Anesthesia complication, kinking of endotracheal tube, pediatric endotracheal tube*

INTRODUCTION

Pediatric endotracheal (ET) tubes are thin walled and likely to be kinked intraoperatively. Kinking of ET tube can be disastrous if unnoticed or in case of delay in the management.[1,2] To avoid such complications, reinforced ET tubes are commonly used where kinking is anticipated, e.g., head and neck surgery or operation in prone position.

We wish to share our management in a case of unexpected kinking of polyvinyl chloride (PVC) ET tube in a pediatric patient undergoing surgery in supine position. The management is simple and can be useful and lifesaving.

CASE REPORT

A 2-month-old male baby, of weight 4 kg, was scheduled for emergency repair of bilateral inguinal hernia and right hernia was incarcerated. We planned general anesthesia with ET intubation, along with caudal block for this patient. The baby was placed over forced air warming blanket (Bair Hugger®) set at 40°C.

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Intravenous (i.v.) induction of anesthesia (modified rapid sequence) was done with propofol 2 mg/kg, fentanyl 3 μg/kg, and rocuronium 1.0 mg/kg. We accomplished ET intubation (oral) with 3.5-mm-internal diameter ET tube (Portex non-cuffed, PVC) and connected to anesthesia machine (Drager Zeus). The lungs of the baby were being ventilated with 2%-3% sevoflurane and 40% oxygen in air mixture. The mode of ventilation was volume control with tidal volume 20 ml and respiratory rate 30/min. Caudal block was placed with 4 ml of 0.25% bupivacaine. After the block, the baby was turned to supine position and handed over to surgical team which shifted the baby downward to middle of the operating table (as their final operating position). We re-confirmed neutral position of head, equal air entry, and fixed the breathing circuit on the supporting arm of the anesthesia machine. After 10 min of start of surgery, we heard an audible alarm from the anesthesia machine and noticed a decrease in expired tidal volume and rise in peak airway pressure. We checked the ET tube and found that it was kinked at a point between the angle of the mouth and the connector of the ET tube. We repositioned the support arm of anesthesia machine for breathing circuit close to the patient and placed some pieces of the cotton gauze under the tube to support it from below (arrow 1 in Figure 1) which resulted in straightening of the ET tube. We confirmed equal air entry on auscultation of chest, and measured expired tidal volume, and airway pressure returned to the previous readings. After a few minutes, we heard the same alarm again, with concomitant decrease of tidal volume and rise in peak airway pressure, and noted that the ET tube had

Figure 1: Unexpected kinking of endotracheal (ET) tube. Gauze pieces placed under the ET tube (arrow 1) and external reinforcement of ET tube with Micropore tape (arrow 2)

kinked again at the same point. We manually supported the ET tube to straighten it and the chest expansion became adequate once again and ventilatory parameters also returned to acceptable range. To solve the problem of repeated kinking of ET tube, we wrapped an ordinary paper tape (Micropore 3M, 1 inch wide) around the ET tube (about 10 circles) at the point of frequent kinking (arrow 2 in Figure 1) and noted that there was no kinking during the rest of the procedure which lasted for more than 1 h after our reinforcement.

DISCUSSION

PVC ET tubes are commonly used if the surgery is planned to be done in supine position and if the area to be operated is away from head and neck. Kinking of pediatric PVC ET tubes is possible under anesthesia due to their small wall thickness and has been reported even during the surgeries performed in supine position.[3] It presents as high airway pressure and inability to deliver proper tidal volume.[4,5] Usual management in such cases is readjustment of the support arm of the anesthesia machine or placement of cotton pads under the ET tube or to reduce extra length of ET tube outside the oral cavity. In our case, the first two interventions did not work. The third option was to reduce extra length of the ET tube by cutting few centimeters from the connecter end. In our situation, we considered it to be potentially dangerous in case of difficulty in re-inserting the connector into the ET tube or accidental dislodgement of the ET tube during the manipulation.

Reinforced ET tubes are resistant to kinking and are commonly used in the situation where kinking is anticipated. As we did not expect intraoperative kinking of the ET tube, we did not use it from the very start. However, while encountering repeated intraoperative kinking, we thought of replacing PVC ET tube with a reinforced ET tube; but we considered it impractical, especially in the middle of the surgery when the baby had already moved to a position away from the anesthetist. Additionally, bringing the baby toward the head end of the operating table would have spoiled the sterilized drape sheets and would have been inconvenient for the surgeon.

Yamashita and Motokawa described a technique of preventing kinking of pediatric PVC ET tube by externally reinforcing it with an additional bigger size tube.[6,7] It can be useful only in the situation when kinking of ET tube is anticipated or when a reinforced ET tube in not available. There is only one report in the literature of intraoperative use of externally reinforced ET tube.[8] The authors used this ET tube (in case of nonavailability of reinforced ET tube) in a pediatric neurosurgical surgery patient who was being operated in prone position and the PVC tube had kinked. The baby's head was fixed with Mayfield pins and had to be turned supine for re-intubation with an externally reinforced ET tube. In our opinion, the authors should have anticipated the kinking of ET tube in this patient and should have intubated the trachea of the patient with externally reinforced tube from the very start of anesthesia. We did not use externally reinforced tube in our patient because we wanted to avoid re-intubation due to the reasons mentioned above.

Warming of the ET tube at body temperature can be a contributing factor in its softening and may result in kinking.[9,10] We feel that use of Bair Hugger set at 40°C might have contributed to its softening and tendency to repeated kinking.

On search of the literature, we did not find any such report of intraoperative reinforcement of ET tube with a commonly available stuff. The technique is easy and can be tried before replacing PVC ET tube with reinforced ET tube in the situation of unexpected kinking of ET tube.

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