Breathing circuit obstruction caused by kink in the reinforced kink-resistant circle system tube

Sir,

Anaesthesia breathing circuits are designed to avoid kink and the risk of obstruction. We report a case of difficulty in ventilating a patient caused by obstruction in a kink-resistant circle system tube.

A Draeger Fabius CE® anaesthesia machine with reusable silicon-reinforced kink-resistant circle system was checked and found to have no leak and normal compliance. An ASA 1 patient posted for a urologic procedure was intubated and connected to the circle system and was put on ventilator. Anaesthesia was maintained with N₂O and isoflurane in 33% O₂. On auscultation, the air entry was equal and airway pressure was 14 cm of H₂O. The patient was maintaining oxygen saturation of 100%. Patient was shifted downwards to be placed in lithotomy position. Immediately airway pressure reached the limit of 35 cm of H₂O and the desired tidal volume could not be delivered. The chest expansion was not adequate and the patient's oxygen saturation dropped to 86%. On auscultation, there were no rhonchi. The patient could be easily ventilated with a self-inflating bag and was found to have normal compliance. So, an obstruction in anaesthesia circuit was suspected. But no apparent obstruction could be seen. A thorough examination of the breathing circuit showed crowding of rings of the circle system tubing near its attachment to the CO₂ absorber and the inside tube was found to be folded on itself leading to almost complete obstruction [Figure 1]. This was caused by the rotational tension in the circuit created while the patient was being shifted down for lithotomy position. On removing the tension in the circuit and unwinding of the tube, the airway pressure dropped to 14 cm of H₂O and ventilation was successful. The patient's oxygen saturation improved to 99%. There was no difficulty in ventilating the patient subsequently.

The kink in the disposable plastic tubing of the circle system causing difficulty in ventilating the patient has been reported. To avoid such complications, kink-resistant tubes were developed. The breathing tubes are reinforced with circular silicone rings so as to make the system non-kinkable. Although breathing tubes are at a risk of kinking if bent acutely, the corrugated tubes tend to resist kinking compared with the straight ones, when bent gently. There are no published cases of obstruction in the non-kinkable breathing circuit. Due to the presence of continuous rings, we could not make out any obstruction. But on close examination, the presence of crowded rings hinted at the possibility of inside tube getting compressed. Thus, rings obscured the vision of the tube and made the identification of obstruction difficult.

We had followed the ASA recommended practice of checking the breathing circuit integrity by using two-bag technique and visual inspection of tube for the integrity. There were no problems. Thus, even after machine check and observation of the breathing tube, we can miss out the tube kink caused by the torsion in breathing tube. Avoiding torsion in the system may reverse the kink.

In case of unexpected obstruction to ventilation during anaesthesia, it has been proposed that the first step is to ventilate the patient manually to disprove the ventilator as a source of obstruction. The rapid elimination of the equipment as a source of obstruction will not only relieve the obstruction to the ventilation in significant number of patients, but also markedly reduce the diagnostic dilemma. We followed the guidelines, and therefore were able to eliminate patient factors and endotracheal tube as the cause of obstruction.

We conclude that we should be aware of the possibility of kink in silicon-reinforced non-kinkable tubes and
crowding of the rings in some part of circuit which may give a clue about the possible source of kink. After any movement of circuit, removing torsion in the circuit by straightening the circuit will remove most of the kink.

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