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Anaesthetic Breathing Circuit Obstruction Due to Blockage of Tracheal Tube Connector by a Foreign Body—Two Cases

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SUMMARY

Two cases are presented which illustrate the disastrous consequences possible when an anaesthetic breathing circuit is obstructed by a foreign body. Despite reports of previous similar cases, work practices and equipment manufacture or design continue to allow for such events to occur. The importance of both pre-anaesthetic testing of the entire circuit including attachments such as the tracheal tube connector and filters, and the removal of these parts should obstruction occur, is emphasised. Use of "clear" transparent breathing circuit components and opaque or brightly coloured packaging and caps which could potentially cause obstruction should decrease the incidence and facilitate the diagnosis of this problem.

Key Words: TECHNIQUES; EQUIPMENT: breathing circuit, tracheal tube; COMPLICATIONS: obstruction, foreign body, tracheal tube connector, crisis management

CASE I

A 35-year-old male was brought to the Accident Unit following a high-speed motor vehicle accident. On arrival, he had bilateral fractures of ribs 3 to 6 with presumed pulmonary contusion and a blood alcohol of 0.20 gm/dl. Over the next six hours, he remained relatively stable haemodynamically but was noted to have a falling haemoglobin oxygen saturation (SaO_2) which required supplemental inspired oxygen to maintain an SaO_2 of 95%. Due to increasing abdominal pain, an abdominal proof puncture was performed. This was positive for blood and he was scheduled for laparotomy. After several minutes preoxygenation, a rapid sequence induction was performed and he was easily intubated. There was complete obstruction to ventilation. The tracheal tube was removed and a second tracheal tube inserted with no improvement. A suction catheter was passed without significant resistance through the swivel connector down the tracheal tube. The patient's SaO_2 rapidly decreased. Bilateral chest needles were inserted to exclude pneumothoraces. The tracheal tube was removed and mask ventilation instituted. Hypoxic cardiac arrest ensued and the patient could not be resuscitated. Post mortem demonstrated pulmonary contusion and a mesenteric tear. Examination of the tracheal tube connector revealed an intravenous giving set cover had lodged in the fresh gas inlet of the Portex Blue Line swivel connector, totally blocking inflow of fresh gas (Figure 1).

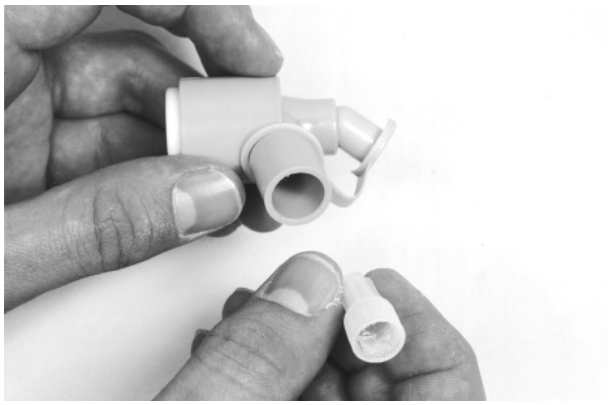

FIGURE 1: Showing Portex Blue Line swivel connector in the left hand and intravenous giving set cover held in the direction in which it lodged.

CASE II

An 82-year-old female with a fractured neck of femur was scheduled for a right Compression Hip Screw under general anaesthesia. Her past medical history included severe dementia, mild chronic airways obstruction, hyperthyroidism and atrial fibrillation.

After preoxygenation for three minutes, a rapid sequence induction was performed with thiopentone and suxamethonium, and the patient was easily

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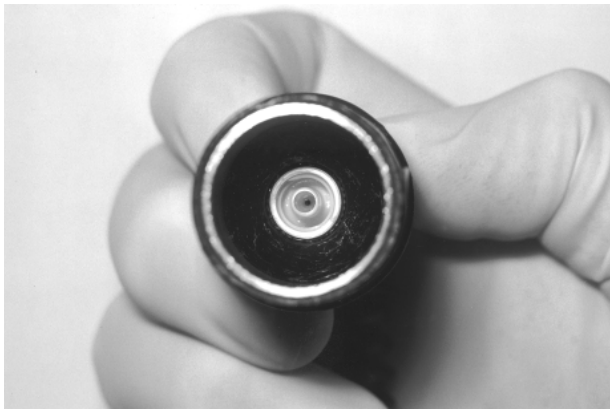

FIGURE 2a: Braun luer lock injection site tightly wedged in black endotracheal tube connector.

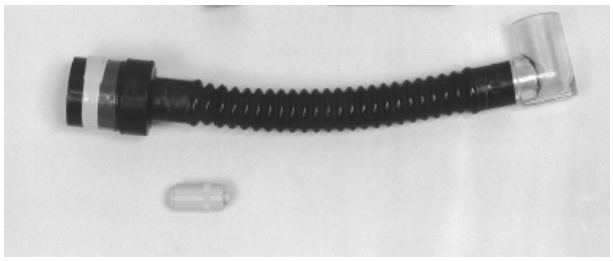

FIGURE 2b: Showing luer lock injection site bung and endotracheal connector.

intubated with a size 7.5 Portex tracheal tube. Ventilation was almost completely obstructed and the SpO_2 fell to 90%. Auscultation of the chest revealed extremely poor air entry despite the use of high manual infla-tion pressures. Repeat laryngoscopy, re-intubation, changing anaesthetic machines, and passing a suction catheter beyond the end of the tracheal tube all failed to correct the obstruction. It was decided to abandon the surgical procedure and transfer the patient to the Intensive Therapy Unit for further investigation and management. During preparation for transport, a Mapleson Class B circuit was connected directly to the tracheal tube, with immediate relief of the obstruction. The anaesthesia and surgery proceeded and the patient made an uneventful recovery.

In this case a concerted effort was made to eliminate the circuit as the cause of obstruction to ventilation. Despite this, when the patient was transferred from the induction room to theatre to access another anaesthetic machine, the tracheal tube connector, which had remained on the patient's bed, was incorporated into the new circuit on the second anaesthetic machine. Examination of the anaesthetic breathing circuit revealed that the black flexible tracheal tube connector ("Liquorice Stick") was nearly totally obstructed by a BRAUN luer lock injection site ("yellow bung") for intravenous cannulas (Figures 2a and 2b).

DISCUSSION

These cases illustrate the potential difficulty in diagnosis and the possible disastrous consequences when an anaesthetic breathing circuit is obstructed by a foreign object. A literature search (Ovid Medline) revealed numerous reports of similar incidents (refs 1-8). Despite these reports there continues to exist a situation where both work practices and equipment manufacture or design allow for anaesthetic breathing circuit obstruction due to foreign body.

The authors recommend the following to minimise the incidence of such events and the likelihood of an adverse outcome should such an obstruction occur.

1. Transparency of Circuitry

A significant number of the reported obstructions to anaesthetic breathing circuits occurred in equipment which was opaque. The entire anaesthetic breathing circuit should be composed of "clear" transparent material. Packaging material of anaesthetic equipment and items such as caps for intravenous ports and gas sampling sites should be composed of brightly coloured material so that they can be easily identified if accidentally incorporated into the circuit.

2. Eliminate the "Whole" Circuit

In the case of unexpected obstruction to ventilation during anaesthesia it is recognised that the elimination of the anaesthetic breathing circuit as the cause of obstruction is an immediate priority (refs 9-10). The Crisis Management Algorithm of W. B. Runciman et al (ref. 10) outlines the steps involved in the process of eliminating the whole circuit. The first step involves systematically checking the tracheal tube (or other airway in use) including removing and replacing if required. The second step is elimination of the anaesthetic machine and ventilating with a self-inflating (e.g. Air Viva) bag.

The rationale behind first eliminating the circuit when clinicians are faced with a case of obstruction to ventilation is simple. The obstruction will either be due to equipment or patient factors, therefore the rapid elimination of equipment as the source of obstruction will not only relieve the obstruction to ventilation in a significant number of cases but will also markedly reduce the diagnostic dilemma faced by the clinician.

It is unfortunate that in both these cases the cause

of the obstruction, the tracheal tube connector, was retained in the process of attempting to relieve the obstruction by changing equipment. These two case reports illustrate very clearly the dangers of failing to eliminate the "whole" circuit (including tracheal tube connectors, filters, etc) when dealing with a case of unexpected airway obstruction.

3. Check the "Whole" Circuit

It is recommended pre-anaesthetic practice to check the anaesthetic breathing circuit. The Australian and New Zealand College of Anaesthetists policy document "Protocol for Checking the Anaesthetic Machine" (ref. 11) paragraph 2.2.2.4.2 describes a two bag (simulated lung) technique as the recommended process for checking the integrity of the circle system. The authors recommend that the process of testing the anaesthetic breathing circle as outlined in the above policy document should include performing the "two bag" test on the whole circuit, including tracheal tube connectors and filters. Further, it is suggested that checking of the tracheal tube, laryngeal mask airway, cuffed oropharyngeal airway and face mask include a visual and physical inspection of patency.

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