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Endotracheal tube cuff leak: Minor product defect or lack of cuff pressure monitoring?

Sir,

We report a leak in the pilot inflation line of an endotracheal tube (ETT) resulting in partial loss of tidal volume and increased risk of pulmonary aspiration. It also brings out the significance of intra-operative cuff pressure monitoring.

A 60-year-old man, body mass index 30 kg/m^2, a case of acute subdural hematoma and subarachnoid hemorrhage with increased intracranial pressure and deteriorating sensorium (Glasgow Coma Scale 6) was admitted to the intensive care unit. The history of preoperative fasting and other co-morbidities was unreliable. After a quick routine pre check for cuff patency of the ETT by inflation and cuff inspection followed by rapid deflation, the patient was intubated with a size 8.0 mm ID ETT (Ruschelit® Safety Clear Plus, Teleflex Medical Sdn Bhd, Kamunting, Malaysia) and the cuff was inflated with air and manually palpated to assess adequacy of its pressure. He was mechanically ventilated and other measures to control intracranial pressure were initiated. The patient was shifted to the operation theatre for an emergency craniotomy. Nitrous oxide and oxygen 60:40 sub-minimum alveolar concentration isoflurane and propofol infusion 50–100 μg/kg/min were used for maintenance. During the period of approximately 45 min from the time of intubation to the beginning of surgery, a loss of tidal volume was noticed. A check laryngoscopy

ruled out tube migration. The cuff appeared lax and was re-inflated but the events repeated in the same manner again. The ETT was changed with another one and examined for obvious leaks. This ETT was then immersed in a bowl of water and the cuff inflated with an aneroid manometer (Mallinckrodt Medical Athlone, Ireland). Multiple air bubbles were noticed to appear at higher cuff pressures (>100 cm H_2O), but as the pressure was reduced gradually, their size, number and speed lowered, and the bubbling stopped at the cuff pressure below 40 cm H_2O. The leak was detected from the point where the transparent pilot inflation line entered the blue stem of the pilot cuff [shown by the arrow in Figure 1]. The product defect was communicated to the manufacturers.

A leak from any part of the ETT assembly can be alarming, more so in cases of difficult airway or in surgeries involving limited access to airway (non-supine position and head and neck surgery) where a change of tube may not be possible intra-operatively.[1] It may cause increased risk of pulmonary aspiration and inadequate ventilation (inadequate depth of anesthesia, intra-operative awareness, and hemodynamic instability).

The leaks in the cuffs and the various ways to tackle them are well known but a defect in the pilot inflation line has been sparsely reported in the literature.[2] Various methods using continuous inflation with air, saline or lignocaine jelly or use of three-way stopcock to maintain cuff pressure are documented, though most of them are no more than a rescue measure.[1]

This report alarms the caregiver to be vigilant at all times as even minor leaks from unusual sites may have clinically significant and long-standing consequences. Besides, it also reinforces the need for objective monitoring of the ETT cuff pressure, especially in the presence of nitrous oxide (which readily diffuses into the cuff and increases its pressure). Manual assessment of cuff pressure may be grossly incorrect and may underestimate pressures.[3] The pressure can be high as to manifest minor leaks (even when high volume low-pressure cuffs are used), as seen in the case reported. The effects of the leak due to the minor product defect could have been avoided if the cuff pressure was measured and maintained within the safe range of 20–30 cm of H_2O.[4]

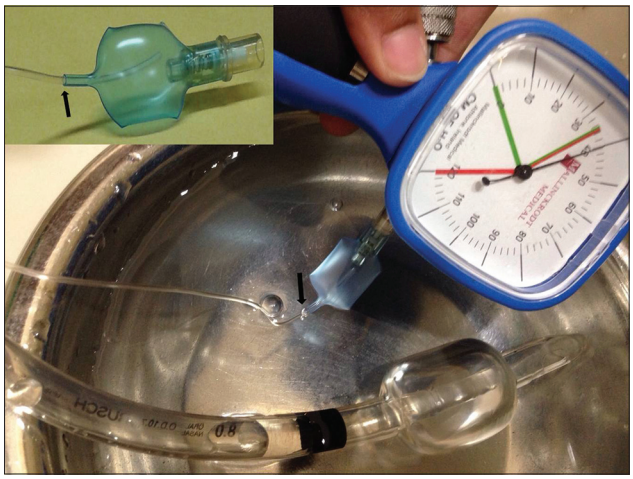

Figure 1: Arrow showing air bubbles in water at higher cuff pressure; inset showing pilot inflation line entering the pilot cuff with the arrow showing the probable leak site

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