Carbon dioxide embolism during endoscopic thyroidectomy

Sir,

A 48-year-old American Society of Anesthesiologists physical status I patient, weighing 68 kg with diagnosis of bilateral thyroid nodules (4 cm × 5 cm) and euthyroid, was posted for endoscopic total thyroidectomy. General anaesthesia was induced and maintained following a standardised protocol. Intra-operatively, heart rate (HR) ranged from 70 to 90/min, systolic blood pressure (BP) 110–130 mmHg, and oxygen saturation (SpO_2) 99–100%. Electrocardiogram showed normal sinus rhythm. Respiratory rate and tidal volume were adjusted to maintain end tidal carbon dioxide ($EtCO_2$) between 30 and 35 mmHg.

By the end of 3 h, dissection of gland was complete with good haemostasis. Suddenly, $EtCO_2$ dropped from 34 to 8 mmHg, SpO_2 to 60%, with hypotension (BP-80/50 mmHg) and bradycardia (HR-42/min). There were no disconnections or leaks in the circuit. Auscultation was not possible as the surgical ports were placed at axilla and areola of nipple bilaterally, but chest showed adequate and equal expansion.

With a presumptive diagnosis of pulmonary embolism, surgery was stopped and sample for an arterial blood gas (ABG) was sent. The patient position was changed from head up to head down, but we were not able to give left lateral position as laparoscopic ports were still *in situ*.

The diagnosis of pulmonary embolism was presumed with ABG showing pH of 7.081, $PaCO_2$ 84.5 mmHg, PaO_2 61.2 mmHg and bicarbonate 24.0 mmol/L corresponding to an $EtCO_2$ of 8 mmHg. After administration of glycopyrrolate 0.2 mg, ephedrine 6 mg and 100% O_2, in 5 min the HR was 84/min, BP 130/86 mmHg, SpO_2 98% and $EtCO_2$ 34 mmHg. An arterial line was introduced and ABG taken at this point showed pH 7.38, pCO_2 33.8 mmHg, pO_2 165 mmHg, bicarbonate 19.7 mmol/L. A re-evaluation of the equipment and settings showed CO_2 inflation pressure erroneously set at 20 mmHg.

As the only remaining surgical procedure was external removal of the already dissected gland, endoscopy was allowed again. The inflation pressure was reduced to 14 mmHg, positive end-expiratory pressure (PEEP) of 6 cm H_2O was added and an intravenous fluid bolus of about 500 ml was administered. Surgery lasted for 30 min longer and was uneventful with a normal $EtCO_2$ (32–34 mmHg), vitals and ABG (pH 7.313, pCO_2 41.2 mmHg, pO_2 229 mmHg, bicarbonate 20.3 mmol/L). At the end of surgery, patient was reversed of neuromuscular blockade and trachea extubated.

Clinically significant carbon dioxide embolism is a rare but potentially fatal complication and may result from direct intravascular insufflation of CO_2 during surgery.[1] During neck surgeries, many vessels need to be dissected and it is possible to miss a tear in a small vein as it may remain collapsed due to compression by gas under pressure in the cavity created by the inflated gas. If the intra-cavitary pressure is high, gas can be forced into circulation through the opening causing pulmonary embolism.

Gas embolism should be suspected if there is a sudden drop in $EtCO_2$[2,3] and is suggestive with hypercarbia and hypoxia. This indicates a failure of gas exchange due to reduction in alveolar perfusion. The sudden recovery following discontinuation of CO_2 in our case could be explained by the high solubility of CO_2. The blood gases with normal bicarbonate at the point of occurrence of the embolus could be explained by the fact that renal compensation may not have occurred at the time of the event.

Although a transthoracic or trans-oesophageal echo could have confirmed the diagnosis,[4] the rapidity of events did not allow us to get the monitors. Aggressive volume expansion and PEEP reduce gas embolism by increasing venous pressure.[5,6] This incident stresses the chance of carbon dioxide pulmonary embolus during endoscopic surgeries. Although definitive confirmatory tests may be unavailable at the time of manifestation, continuous $EtCO_2$ monitoring and vigilance may help in an early detection. Timed appropriate treatment may help in the management of this potentially catastrophic situation.

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Conflicts of interest
There are no conflicts of interest.

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