Pneumothorax and cardiac arrest caused by speaking valve mistaken as moisture exchanger: an incident report

Editor—Patients with tracheostomy represent an increasing population, which is at risk of major airway complications because of invasive procedures, comorbidities, and lack of experience of the staff managing these patients.\textsuperscript{1,2}

An 81-yr-old female patient underwent an elective surgery to replace a temporary percutaneous tracheostomy by a conventional surgical tracheostomy. The former surgery was performed to protect the tracheobronchial tree from aspiration after stroke with left-sided hemiplegia and aphasia.

During the surgical tracheostomy under general anaesthesia, the uncuffed tracheal cannula was removed and an oral tracheal tube was used for the lung ventilation. After the tracheostomy had been established, a standard cuffed tracheostomy tube (I.D. 10.0 mm) was inserted. At the end of the surgery and after establishing spontaneous breathing, a speaking valve, previously connected to the uncuffed tracheal cannula before the surgery (Fig. 1A), was attached to the cuffed tracheostomy tube. This device resembled and was thought to be a moisture exchanger device (Fig. 1B) with oxygen supply.

Two minutes later the patient started coughing and developed progressive bradycardia resulting in an asystole. Chest compressions and manual ventilation were started. After lung auscultation, which revealed bilateral dull spastic sounds and suspected tension pneumothorax, two 14-gauge cannulas were inserted bilaterally at 2/3 intercostal space. A bolus of epinephrine 1 mg was given. Spontaneous circulation returned after 13 min of manual chest compression. Chest X-ray, performed at ICU, confirmed the pneumothorax on the left side and emphysema of the skin. The following endoscopy did not find any other bronchial and oesophageal lesions. During the next 5 days, the circulation and cerebral function recovered to the state the patient had before the accident and the patient was discharged from the hospital on the 10th postoperative day.

A speaking valve is a one-way airflow device, which is attached to the distal end of the uncuffed tracheostomy tube to allow speaking trials. The expiration is blocked (Fig. 1C); during the breathing, the air passes around the proximal end of the tracheostomy tube through the vocal cords and then exits via the nose and mouth. The application of a speaking valve, mistaken as moisture exchanger in the present case, had led to blocked expiration in a cuffed tracheostomy tube, increased end-expiratory pressure above the physiological values within seconds with following cardiac arrest. The acute lesion of pulmonary tissue and subsequent positive pressure ventilation led to tension pneumothorax. The attached oxygen supply probably accelerated this pressure increase.

The visual similarity between speaking valve and moisture exchanger (Fig. 1A and B) and the limited capability of the patient with severe neurological problems were obviously the reasons for this life-threatening event.

Fig 1 Visual similarity between both devices, described in the case report: (A) Spiro speaking valve with a warning symbol (black triangle with an exclamation sign inside it); (B) heat and moisture exchanger tracheolife II. Below is the schematic presentation of air circulation in both devices: (C) speaking valve is a one-way airflow device, where the expiration is blocked; (D) both in- and expiration are possible via the moisture exchanger.

In order to prevent the potential misuse, according to European law regulation on medical devices [http://www.iso.org/iso/home/store/catalogue_ics/catalogue_detail_ics.htm?Csnnumber=50335 (accessed 29 October 2012)] speaking valves are supplied with a graphical symbol (black triangle with an exclamation sign inside it, Fig. 1A). However, it is known that even experienced clinicians neglect such graphical symbols on medical devices.\textsuperscript{3,4} We believe that fatal events because of mistaken assembly of the breathing system components can be prevented by: (i) intelligent design of medical devices; (ii) appropriate education of the staff (including storage and double-check of the equipment); and (iii) reporting of the incidents to authorities in-charge and to medical community.
Acknowledgement

The authors thank Manuela Janke for her assistance in preparation of Figure 1.

Declaration of interest

None declared.

Funding

The work was supported by internal funding of the Department of Anaesthesiology and Intensive Care Medicine, University of Greifswald.

S. Selleng
M. Antal
T. Hansen
K. Meissner
T. I. Usichenko*
Greifswald, Germany
*E-mail: taras@uni-greifswald.de

doi:10.1093/bja/aet236

Psoas compartment block for anaesthesia during surgical repair of inguinal hernias

Editor—Local anaesthetic infiltration is recommended for inguinal hernia surgery but may become a challenge in patients with voluminous inguinal hernias or obesity, as large doses of local anaesthetic and sedation may be needed. Moreover, general or spinal anaesthetic techniques may be unsuitable in high-risk patients.

Anatomical, imaging and clinical studies suggest that psoas compartment block (PCB) performed at L2–L3 level has a high chance to involve L1–L2 roots, and thus can be suitable for inguinal surgery.1–3 We describe a modified access for PCB as an effective alternative to local anaesthetic infiltration in patients undergoing surgical repair of inguinal hernias.

In our institution, we introduced a modified PCB performed in lateral decubitus by a 120 mm stimulated needle inserted at the junction between the lateral third and the medial two-thirds of a line drawn at L2–L3 interspace, between the interspinous line and a line passing through the posterior superior iliac spine (PSIS), parallel to the interspinous line (Fig. 1). If twitching of the anterior thigh area is observed, the needle is moved more cranially. When twitching of the inguinal field is observed, ropivacaine 5 mg ml⁻¹, 25–30 ml, is injected. Negative pinprick testing at incision line is generally reported 20–30 min after PCB.

In our experience, this technique allows inguinal surgery in awake patients without any effect on haemodynamics. Patients may need light intra-operative sedation and gentle manipulation of tissues because the peritoneal sac has visceral innervation and the spermatic cord and the testes, whose innervation can be tracked up to T10, may not be fully blocked. Patients are usually able to cough if requested by the surgeon. Postoperative analgesic consumption is minimal and home readiness criteria are achieved within few hours.

Nonetheless, PCB may be associated with complications such as hypotension, epidural or subarachnoid spread, systemic toxicity, renal puncture, and retroperitoneal haematoma.4–6 Sensory block, with or without motor block, of the femoral nerve presenting as hypoaesthesia of the anterior thigh skin and paresis of the quadriceps muscle may also occur.

We do not consider PCB as a first-choice technique in lower abdominal wall surgery, but, in selected cases presenting difficult surgical or clinical management (e.g. patients with American Hernia Society type III–VI voluminous inguinal hernias or obese patients), it may represent a useful alternative that deserves to be studied in larger randomized trials. Moreover, this technique needs further study for the detection of the optimal site of injection and of the ideal local anaesthetic volume for lower abdominal wall surgery.

Declaration of interest

None declared.