

issues of a poor medical and nursing environment and sometimes non-cooperative patients. A nasogastric tube is often not well tolerated. Whereas intravenous (i.v.) catheterization is considered as invasive, the subcutaneous space is considered as a useful route for fluid diffusion or infusion. Compromised peripheral venous vascularization can be another indication for hypodermoclysis as an alternative to central venous access. Evidence-based studies are lacking [1]. Three main sites can be considered: arms or legs are the safest choices, but are limited by induced discomfort or unintentional removal during movement. Abdomen puncture is an alternative. The left iliac fossa should be chosen because at that point there is a maximal distance between the colon and the abdominal wall. Careful aspiration is the rule before injection so as to detect vessel injury or air aspiration. Only one case of major infection has been reported [2]. Obesity or insulin injection does not increase the risk of iatrogenic complications [3]. In the same way no colonic perforation during ascites paracentesis has been described. Colonic damage occurs mostly from inside to outside during endoscopic procedures or after foreign body ingestion. Prognosis depends on treatment delay [4] because of peritonitis. Perforation could be favoured by a thin and slim abdominal wall musculature related to old age. The CT scan findings are easily explained by the mechanism of colonic injury. Intestinal distension is explained by the reflex ileus encountered during peritonitis. More interesting is the presence of subcutaneous emphysema related to the diffusion of the pneumoperitoneum through the needle track.

To conclude, physicians should be alert to the possibility of potential life-threatening complications

linked with the subcutaneous route. Nevertheless, owing to the favourable benefit/risk balance hypodermoclysis seems a good alternative to i.v. or oral rehydration in the elderly as long as basic safety rules are respected.

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Anaesthetic considerations in parathyrotoxic crisis

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EDITOR:

Primary hyperparathyroidism (pHPT) is the most common cause of hypercalcaemia, accounting for more than 50% of cases [1]. Symptoms associated with hypercalcaemia generally correlate with both

the magnitude and the rapidity of the increase in serum calcium. However, patients vary in their sensitivity to serum calcium elevations.

Hypercalcaemia increases the risk of anaesthesia because of potentially dangerous disturbances in cardiac rhythm. Moreover, HPT has been reported to coexist in 20–60% of the cases with nodular thyroid disease. Perioperative management of these patients should, therefore, include careful evaluation of the airway as the extent of compression and deviation caused by the mass can lead to a

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difficult intubation [2]. Furthermore, meticulous monitoring of neuromuscular blockade should be performed since it has been suggested that hypercalcaemia associated with primary HPT may antagonize the effects of non-depolarizing muscle relaxants [3]. We report here on the anaesthetic management of a patient who presented with parathyrotoxic crisis.

Case report

A 30-yr-old male presented to the emergency department with progressive dyspnoea and subsequent nausea and vomiting of 2 days duration. Physical examination revealed a mass on the left side of the neck that moved with swallowing and a fine stridor was clearly audible during inspiration.

Laboratory tests revealed the following: white cell count $11\,950\ \mu\text{L}^{-1}$; haematocrit 43.7%; platelet count $278 \times 10^3\ \mu\text{L}^{-1}$; glucose $119\ \text{mg dL}^{-1}$; urea $57\ \text{mg dL}^{-1}$, creatinine $1.5\ \text{mg dL}^{-1}$, serum calcium $16.1\ \text{mg dL}^{-1}$, uric acid $16.1\ \text{mg dL}^{-1}$, sodium $148\ \text{mmol L}^{-1}$ and potassium $4.9\ \text{mmol L}^{-1}$, hormonal control and immunohistochemical staining demonstrated parathyroid hormone (PTH) level of $630\ \text{ng L}^{-1}$.

Ultrasound demonstrated a parathyroid adenoma in the lower left pole of a goitrous thyroid gland. Chest X-ray showed compression and deviation of the trachea caused by a goitre that extended into the mediastinum. Electrocardiography showed shortening of the QT segment. The diagnosis of parathyrotoxic crisis was made and the patient was scheduled for emergency parathyroidectomy.

Routine preoperative assessment of the patient's airway showed mouth opening of 30° , Mallampati score III, satisfactory neck mobility and thyromental distance 5.6 cm.

The patient received 6L of normal saline during the first 24 h. Subsequently loop diuretics (furosemide $20\ \text{mg 4 h}^{-1}$) were administered to produce a diuresis of $200\ \text{mL h}^{-1}$. Corticosteroids (prednisolone $100\ \text{mg day}^{-1}$) and biphosphonates (pamidronate 90 mg) were also prescribed.

Serum calcium was reduced to $11.8\ \text{mg dL}^{-1}$ at 48 h. Fiberoptic awake endotracheal intubation was successful without bleeding or other complications, with a time of intubation of 4.6 min.

A bolus dose ($2.0\ \text{mg kg}^{-1}$) of propofol was given followed by remifentanyl ($1\ \mu\text{g kg}^{-1}$) and parecoxib 40 mg. After loss of the eyelash reflex, *cis*-atracurium $0.2\ \text{mg kg}^{-1}$ was administered. Lung ventilation was titrated to achieve an end-tidal carbon dioxide (ETCO_2) of 32–36 mmHg. Anaesthesia was maintained with sevoflurane (end-tidal 1.3%) with a mixture of 35%

oxygen in air at a fresh gas flow of $8\ \text{L min}^{-1}$ and remifentanyl $0.1\text{--}0.2\ \mu\text{g kg}^{-1}\ \text{min}^{-1}$. The infusion of remifentanyl was adjusted in order to maintain mean arterial pressure (MAP) and heart rate (HR) within a 20% range of the preoperative values, and the value of bispectral index between 40 and 60. Neuromuscular blockade was monitored by measuring the contraction of the abductor pollicis using peripheral nerve stimulator after supramaximal stimulation of the ulnar nerve at the elbow in a train-of-four (TOF) pattern. Neuromuscular blockade was subsequently maintained with repeated doses of $0.03\ \text{mg kg}^{-1}$ *cis*-atracurium, whenever the first twitch (T1) recovered to 25% of control and this took 26.9 min. Systolic, diastolic and MAP, HR and body temperature were stable throughout the whole procedure ($85 \pm 5\ \text{mmHg}$, $47 \pm 3\ \text{mmHg}$, $56 \pm 4\ \text{mmHg}$, $75 \pm 9\ \text{min}^{-1}$ and $36.1 \pm 0.2^\circ\text{C}$, respectively).

After completion of surgery, which lasted for 115 min, residual neuromuscular block was reversed with 2.5 mg neostigmine and 1 mg atropine. The response to neostigmine was rapid and the TOF ratio had recovered to 0.75 in 4.9 min. The ionized calcium concentration showed a significant decrease to $4.2\ \text{mg dL}^{-1}$ after removal of the adenoma. Calcium was subsequently administered at a rate of $0.5\ \text{mg kg}^{-1}\ \text{h}^{-1}$.

Upon return of spontaneous respiration, the trachea was extubated and the patient sent to the recovery room. He was discharged the 10th postoperative day.

Discussion

pHPT is the commonest cause of hypercalcaemia. Often the patients are elderly females who are found to have a benign adenoma of a single parathyroid [1]. Symptoms associated with hypercalcaemia include muscle cramps, laryngeal spasm, bronchospasm, bradycardia, arrhythmias, anxiety, constipation, anorexia, nausea and vomiting. Poor fluid intake and fluid loss due to emesis are responsible for dehydration and may contribute to an acute hypercalcaemic crisis. Therefore normal intravascular volume and electrolyte status must be restored before anaesthesia and surgery. Therapeutic strategy includes increasing urinary calcium excretion by means of hydration and diuresis.

Our patient presented with dyspnoea due to an enlarged thyroid that compressed and displaced the trachea. Bentrem and colleagues showed that 18% of patients with HPT had concomitant thyroid disease [4]. Goitre, when accompanied by tracheal compression, constitutes an aggravating factor for difficult airway, but no resistance has been encountered in passage of the endotracheal tube

through the compressed or narrowed portion of the trachea [2]. For this reason, fiberoptic endotracheal intubation is advisable.

Ljunghall and colleagues showed that patients with HPT who were apparently asymptomatic preoperatively did not have defects of their neuromuscular transmission that were of clinical significance [5]. In asymptomatic pHPT neither consistent abnormality of neuromuscular transmission nor abnormal muscle structure was found [6]. On the contrary, Al Mohaya and colleagues reported a decreased response to both succinylcholine and atracurium in a patient with parathyroid adenoma [3].

In patients there was a decreased duration of action of *cis*-atracurium. There was recovery of T1 to 25% of control at 26.9 min and repeated doses of *cis*-atracurium (0.03 mg kg⁻¹) administered to maintain relaxation during surgery provided a clinical duration 10.2 ± 0.8 min. Wuffel and colleagues reported that recovery index 25–75% and time to a TOF ratio of 0.70 of *cis*-atracurium were prolonged significantly by sevoflurane compared with total intravenous anaesthesia [7]. However, in our patient, increased minimum alveolar concentration (MAC) of sevoflurane did not result in significant effects on duration of or recovery from the block. On the contrary, recovery was considerably shorter in our patient. Intraoperative electrolytes and acid–base balance status were normal and normothermia was maintained.

In conclusion, special attention should be paid to neuromuscular function monitoring in patients with pHPT.

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Changes in the cerebral state index (CSI) during intraoperative cardiac arrest

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EDITOR:

The Cerebral State Monitor (CSM, Danmeter A/S, Odense, Denmark) is a portable electroencephalogram (EEG)-based device used to evaluate anaesthetic depth. It shows a non-dimensional scale between 0 and 100 that corresponds to the cerebral state index (CSI).

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A CSI value between 40 and 60 is considered to be optimal for surgical anaesthesia. As the CSI value approaches zero, the burst suppression ratio (BS%), which indicates the amount of isoelectric EEG, increases, suggesting cerebral hypoperfusion [1]. There are references in the literature suggesting the usefulness of similar systems, particularly the bispectral index (BIS) and patient state index (PSI), in states of intraoperative cerebral hypoperfusion [2,3]. In this report we describe the use of CSM to assess the effectiveness of cardiopulmonary resuscitation (CPR) during a complex oncological procedure.