required. General anaesthesia was induced with thiamylal 4 mg kg\(^{-1}\), and tracheal intubation was facilitated by vecuronium 0.1 mg kg\(^{-1}\). Anaesthesia was maintained with isoflurane and nitrous oxide 66% in oxygen.

Case 1. A 51-yr-old man with a left-sided coral-shaped calculus underwent percutaneous nephrolithotripsy twice. During the operations, three types of postural change were required—from supine to lithotomy, lithotomy to prone and prone to supine position. 

Case 2. A 56-yr-old man with a mandibular fracture underwent plate fixation and plate removal procedure after 1 yr. Nasotracheal intubation was required because of previous oral surgery.

At the end of the operation, atropine 0.02 mg kg\(^{-1}\) and neostigmine 0.02 mg kg\(^{-1}\) (half of the normal neostigmine dose), were given slowly to antagonize the neuromuscular block, and the trachea extubated. In both cases, anaesthetic management was uneventful, and no abnormality was detected on the ECGs. During the 24 h postoperative period in the intensive care unit, the patients recovered successfully without any worsening of ST segment elevation on the 12-lead ECG.

Careful preoperative evaluation and anaesthetic management is essential to avoid inducing arrhythmia. The high-risk criteria for patients with Brugada syndrome requiring general anaesthesia are: \(^{3,4}\) (i) symptomatic cases with syncope or a medical history of VF; (ii) asymptomatic cases showing pathognomonic ST segment elevation on ECG and medication- or EPS-induced VF; and (iii) cases showing coved-type ST elevation on ECGs.

The mechanism of ST-segment elevation with Brugada syndrome is associated with an imbalance in action potential gradients between the right ventricular endocardial and epicardial cells. Many factors during anaesthesia, in particular the autonomic nervous system, influence this imbalance. \(^{1,3-5}\) Postural change can be regarded as a factor and depth of anaesthesia should be sufficiently controlled before postural change, in order not to disturb autonomic nerve balance.

Neostigmine may augment ST segment elevation in a dose-dependent manner without inducing coronary spasm, \(^{1,3,5}\) while atropine may reduce elevation. \(^{13}\) Therefore, it may be wise to avoid neostigmine. However, in our cases, neostigmine doses were carefully divided and did not cause any abnormalities. There have been several reports of successful neostigmine administration without problems. \(^{1,5}\) We feel, neostigmine can be administered safely by careful dose adjustment and by atropine administration before neostigmine.

Most anaesthetics have inhibitory effects on circulation. However, specific differences and safety of the depressant action in each drug at clinical concentrations remain unknown. Further studies are required to clarify the safest anaesthetic management.

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Diffusive pulmonary embolism with bone fragments during spinal surgery

Editor—We would like to report a case of diffusive pulmonary embolism (PE) with bone fragments during spinal surgery. The patient was a 69-yr-old man (height, 174 cm; weight, 75 kg), with ossification of the posterior longitudinal ligament (OPLL) of the thoracic area and he has a history of essential hypertension. Extensive surgery involving resection of the OPLL from T3–T9 was planned. During general anaesthesia his arterial pressure was maintained at 130–140/60–70 mm Hg. In addition to standard monitors, a radial artery catheter was placed percutaneously but a central venous catheter was not inserted. The patient was placed in the prone position onto a Hall’s frame and surgery was performed. After laminectomy, the resection of OPLL was initiated by posterior approach using surgical drill. Controlled hypotension by continuous injection of nitroglycerine at 0.5 \(\mu\)g kg\(^{-1}\) min\(^{-1}\) was performed at a range of 80–90/40–45 mm Hg. The blood gas analysis during the operation revealed progressive oxygen desaturation and carbon dioxide retention (Table 1). Five hours after the start of resection of OPLL, the patient’s arterial pressure suddenly decreased from 88/45 to 55/30 mm Hg and the ECG showed sinus rhythm at a rate of 70 beats min\(^{-1}\). Severe hypotension (systolic arterial pressure <35 mm Hg) and bradycardia (30–40 beats min\(^{-1}\)) was observed despite the administration of epinephrine and the end-tidal carbon dioxide partial pressure was noted to decrease to 14 mm Hg. The surgical procedure was discontinued and the patient was turned to supine position to carry out a cardiac massage. Despite a cardiac massage the ECG revealed a standstill in electrical activity. Two hours and forty minutes later, resuscitation was discontinued.
An autopsy revealed microscopic diffusive PEs of bone fragments, which were confirmed by calcium stain, in the pulmonary capillary vasculature of all lobe segments in the lungs. However, neither thrombosis nor any air embolism was detected. The pathologist diagnosed the cause of death as microscopic diffusive PE of bone fragments. Vessel occlusion by bone fragments was detected in every section of lung and were more extensive than is found following cardiac resuscitation.

An animal model of experimental PE shows that impairment of oxygenation was less significant after divided bolus of microemboli than single bolus of equal quantity. It is likely in this case that the redistributed pulmonary blood flow might prevent gas change abnormality against the pulmonary vessel occlusion by bone fragments.

The use of a Hasting’s frame, or other devices, increases a gravitational gradient between the right atrium and the vertebrae in spinal surgery. These devices decrease both caval pressure and perivertebral venous pressure, and consequently the patients are placed at risk of venous embolism. In cases of extensive spinal surgery, a central venous catheter should be placed to assist in fluid therapy to maintain central venous pressure beyond the gravitational gradient during operation.

Transoesophageal echocardiography (TEE) is a useful device for evaluating cardiac function and effective to diagnose PE showing typically the enlarged RV and left-sided septal shift. TEE could reflect ventricular diastolic volume for fluid therapy and qualitative assessment of ventricular function when severe haemodynamic change occurs. Cardiac monitoring with TEE should be considered for extensive spinal surgery.

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