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Pulsed saline lavage causing venous air embolism in a patient with Paget's disease

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Summary

Pulsed saline lavage is used to prepare bony surfaces during joint replacement surgery. A patient is described in whom a venous air embolism occurred as a result of a combination of the increased vascularity of bone seen in Paget's disease and possible air entrainment in the lavage equipment. (Br. J. Anaesth. 1996; 76: 330–331)

Key words

Complications, embolism, Embolism, air, Complications, Paget's disease.

Case report

A 71-yr-old man presented for a left cemented Furlong hip replacement to replace an arthritic hip joint. He also suffered from Paget’s disease (osteitis deformans) involving the shaft of his femur and mild chronic obstructive airways disease (COAD). Physical examination was unremarkable except for some basal crepitations consistent with his COAD.

Spinal anaesthesia was produced with 0.5 % heavy bupivacaine 3 ml at the L2–3 interspace with a 22-gauge Whitacre needle after preloading with 0.9 % saline 500 ml. Oxygen was supplied via nasal cannulae at 2 litre min⁻¹ while the patient listened to music via headphones.

Monitoring included non-invasive arterial pressure, electrocardiography, pulse oximetry and verbal contact. Surgery performed in the supine position proceeded uneventfully for the first 100 min, including reaming and cementation of the acetabular component of the joint replacement.

Surgical preparation included use of a Stryker Ortholav pulsed lavage system to irrigate and clean the bony surfaces before cementation. The lavage tip was inserted deep into the femoral shaft such that the outer suction channel was in direct contact with the perimeter of the canal. During femoral lavage the patient complained of feeling unwell with the sudden onset of dyspnoea and coughing. This was associated with a reduction in systolic arterial pressure from approximately 125 to 65 mm Hg, heart rate decreased to 65 beat min⁻¹ after a brief tachycardia of 115 beat min⁻¹ and peripheral arterial oxygen saturation decreased from 95 % to 88 %. A provisional diagnosis of venous air embolism (VAE) was made and treatment consisted of i.v. morphine and ephedrine and changing his nasal cannulae to a face mask and 100 % oxygen. The nature of the operation precluded turning the patient into the classic left lateral position. His cardiorespiratory variables improved to allow cementation and completion of the operation.

Postoperative recovery was uneventful with no evidence of either myocardial, pulmonary or cerebral sequelae.

Discussion

Embolization during hip surgery, of air, surgical debris or cement, particularly during impaction of the femoral component, is well recognized and may occur in up to 30 % of cases [1]. Lavaging the bone and venting the shaft help to minimize these risks. Pulsed lavage uses a peristaltic pump to force saline through connecting tubing and then through a coaxial lavage cannula, the inner tube of which has four side holes at the tip to provide a spray action. The saline and debris are aspirated through the outer tube which is set slightly proximal to the tip and connected to a normal theatre suction apparatus. The Ortholav pump is capable of generating up to 4.7 Barr and a flow of 900 ml min⁻¹. The lavage system operates regardless of the efficiency of the suction apparatus which can be reduced by the presence of large pieces of debris in the tubing.

Normal use of the pulsed lavage may have occluded the stem of the femur and any air trapped distally would have been forced into the femur. A similar event is thought to have occurred during pulsed irrigation of a perineal lesion in a patient with an open pelvic fracture in which trapped air was forced into the venous circulation with subsequent cardiovascular collapse [2]. In the case described here, the volume of air involved would be unlikely to have produced clinical symptoms. The second possible cause related to the lavage system itself. During lavage the saline bag was changed and activation of the machine at this time entrained air into the tubing which was then forced into the femur. During normal use this would not cause problems as the air would be either aspirated into the tubing or vented to the atmosphere but in the presence of a tight seal between the lavage cannula and the femoral canal and an inadequate aspiration system, this could lead to high pressures of air in the femoral shaft with subsequent embolization. The

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possibility of air being entrained in the tubing was demonstrated after operation and confirmed by the manufacturers. Rapid recovery would be consistent with an isolated event. A similar episode has been described during dental implant surgery when inadvertent injection of a mixture of air and water, passing through the hollow dental drill and directly into the mandible, caused death in three patients [3]. A VAE has been reported when injecting air into a femoral bone cyst during an attempt to aspirate it [4], so the increased vascularity seen in Paget’s disease may have made such absorption more likely.

VAE is associated classically with anaesthetized patients undergoing neurosurgical procedures in the sitting position and diagnosis is based on end-tidal carbon dioxide measurements or precordial Doppler monitoring. In this case the latter was not available and the first sign was the patient complaining of breathlessness. The fact that the patient was under central neural block and not receiving nitrous oxide which, in anaesthetic concentrations, increases bubble size by between 200% and 400%, probably contributed to the fortunate outcome. Central venous cannulation is not used routinely but might have been helpful to aspirate any atrial collection of air.

The use of pulsed lavage systems is not universal and it is thought that there are about 120 units in use in the UK of which approximately 50% are supplied by Stryker. The potential for significant VAE during the use of pulsed saline lavage should be remembered, especially in patients who may be at a higher risk of developing this complication, such as those suffering from Paget’s disease. Care should be taken to ensure that air is not entrained in the lavage tubing and the aspiration system is functioning efficiently.

References