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VENOUS AIR EMBOLISM WITH A WATER JET DISSECTOR

Sir,—We read with interest the article by Dr Smith [1], reporting an incident of apparent major air embolism occurring during hepatic resection using a water jet dissector.

We have introduced a water jet dissector (Hepatotom) [2–4] at the Clinic of Visceral and Transplantation Surgery, University of Bern, Switzerland and since 1989 have performed about 50 liver resections with it. Air embolism during hepatic resection is a result of injury to large intrahepatic veins during parenchymal dissection. Negative or low hepatic i.v. pressure results in air being aspirated into these veins. Embolism might also result from cutting more superficially situated veins and presumably this could occur even with injury to smaller veins.

Interestingly, Mastragelopulos and colleagues [5] reported on argon gas embolism occurring during laparoscopic cholecystectomy and coagulation of the liver bed with the Argon Beam Coagulator. The authors recommended caution and suggested keeping the instrument a reasonable distance from vessels and allowing for possible vessel anomalies, with relatively large vessels being close to the liver surface. The same precautions are necessary during use of the water jet dissector.

The report by Dr Smith stated specifically that during parenchymal transsection their patient was in a supine position with a 30° head-up tilt. This is potentially dangerous during liver resection of any kind and we recommend that during the parenchymal phase of the operation the patient should be in a Trendelenburg position of about 15°. This mandatory central venous hypotension is used during parenchymal transsection. This technique averts the risk of air or gas embolism. Using this approach, the danger of air embolism during parenchymal dissection is minimal and one of us (L.H.B.) has performed 150 major hepatic resections without such an incident.

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Sir,—Thank you for the opportunity to reply to the comments of Drs Baer and Blumgart relating to my Case Report of probable venous air embolism (VAE). Their letter raises an interesting issue regarding optimum positioning for hepatic surgery.

A head-up tilt has the advantage of providing excellent surgical access to the liver and, with appropriate volume loading to counter postural hypotension, should maintain positive hepatic venous pressures and make passive VAE unlikely. However, any air that does entrain passes readily to the right atrium and, if sufficient, produces pulmonary hypertension and allows paradoxical systemic air embolism in event of a patent foramen ovale. Furthermore, systemic air is more likely to gain access to the innominate and carotid arteries with head-up tilt, inviting cerebral arterial gas embolism.

Venous capacitance vessels are located predominantly in the pelvic and lower limb structures and consequently a head-down position increases central venous pressure as measured with a right atrial catheter. The liver lies in plane similar to that of the heart in this position, with its major veins draining into the inferior vena cava just below the right atrium, so it may be that mean hepatic venous pressure also increases with head-down tilt compared with horizontal or head-up positioning. This should protect against VAE and any bubbles that might be entrained should float caudally in a large-bore, low-pressure vessel such as the inferior vena cava. The disadvantages of head-down attitude include less satisfactory surgical exposure with venous congestion and bowel tending to invade the field and increased right atrial pressures perhaps tending to open a patent foramen ovale, with obvious risks if air were to reach the right atrium.

Current recommendations for management of cerebral arterial gas embolism advocate horizontal rather than head-down posturing. Bubbles are thought to accumulate anteriorly in the aortic outflow tract and not enter the major neck vessels and the adverse consequences of cerebral venous congestion are avoided.

The approximate 30° head-up tilt in the case reported was certainly greater than usual in our community, where positioning varies from horizontal to about 15° head-up, according to surgical preference. As far as I am aware, no specialist hepatobiliary surgeons here use a head-down tilt.

The matter is clearly controversial and may remain dictated largely by surgical considerations. On balance, I feel that the horizontal position offers the best compromise, but concede that the experience of Drs Baer and Blumgart validates their preference for the head-down posture. Head-up tilt would seem the most dangerous option, even though the operative site is nominally below the heart, and I agree with your correspondents that it should be discouraged.

In conclusion, however, I must reiterate the purpose of my article in drawing attention to the need for addressing the potential of VAE in association with the water jet dissector. The incident reported involved dramatic air entrainment of proportions unlikely to be of passive nature, and the warning to anaesthetists remains serious.

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SPIN LABEL TECHNIQUES FOR DETECTION OF MALIGNANT HYPERTHERMIA

Sir,—The differences in the results obtained by Ohnishi and colleagues [1], Halsall, Ellis and Knowles [2] and Cooper and colleagues [3] may not be solely the result of technical factors relating to EPR spectra, as suggested by Halsall, Ellis and Knowles [4].

It is unclear from the paper by Ohnishi and colleagues [1] which sodium phosphate salt was used. They referred to sodium phosphate (presumably Na_3PO_4). Halsall, Ellis and Knowles [2] have used sodium dihydrogen phosphate. The first invariably requires correction to pH 7.4. It is unclear what effect this has on the availability of the other salts in the buffers.

Calcium has been shown to affect both protein and lipid [5] structure in erythrocytes. Both the incubation and wash buffers used by Halsall, Ellis and Knowles [2] contained calcium.

Methods involving lipid membrane labels usually involve a short incubation period, allowing interpolation of the membrane probe in the bilayer associated with evaporation (or dilution) of the solvent. Alternatively, exchange from Bovine Serum Albumen