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Precordial Doppler is Not Obsolete for Venous Air Embolism Monitoring

To the Editor:—The recent article by Harris *et al.*¹ was very enlightening in demonstrating the high incidence of echocardiographically visualized intracardiac reflectors compatible with venous air embolism (VAE) in supine infants during craniectomy.

However, it should be pointed out that readers without the benefit of two-dimensional echocardiography (ECHO) equipment may effectively monitor for VAE with precordial Doppler. The sensitivity of the precordial Doppler has been measured by Chang *et al.*² and Gildenberg *et al.*³ as being in the same range as that quoted for transesophageal echocardiography. In any case, there is little useful difference in the sensitivity of Doppler as compared to ECHO. ECHO currently has the disadvantage of requiring continuous observation, whereas audible Doppler can be acceptably monitored while performing other tasks.

In as much as venous air emboli are documented in increasing numbers of clinical situations, the real need is for an automated monitor (of whatever type). Such a

monitor must have adequate sensitivity (0.1 ml air/kg), and must function reliably and continuously without the requirement for constant operator attention.

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Air Embolism during Liver Transplantation

To the Editor:—Khoury *et al.*¹ describe the occurrence of venous air embolism associated with veno-veno bypass during orthotopic liver transplant using the Biomedicus centrifugal force pump.

At Baylor University Medical Center we have performed more than 150 liver transplants using veno-veno bypass. We use clear polyvinyl tubing, rather than opaque heparin bonded pump tubing, so that an air detector may be utilized and any large air bubbles may be seen. To date, despite the lack of anticoagulant, we have not seen any evidence of clot formation or fibrin deposition using this system. Extreme care is taken to stay on bypass only if flows greater than 1 l/min can be maintained.

We also reduce the likelihood of an air embolus, as described by Khoury *et al.*, by not instituting bypass until the portal and systemic limbs are fully primed and in the circuit. Thus air cannot be entrained through an

open portal limb. We believe that these modifications of technique provide for a safer operation.

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