in 1976. In the working model, shown schematically in figure 1, the internal jugular vein and brachiocephalic—superior vena cava (SVC) was represented by lengths of rubber dam, set up as Starling-type resistors, enabling the application of external pressure to simulate that generated by the overlying neck tissues or by pleural—mediastinal pressure. Two taps to allow passive entry of air at non-collapsible sites were included on two alternative venous pathways. The level of central venous pressure (CVP) was altered by changing the height of the CVP outlet port, and SVC distension could be influenced by changing the pressure on the lower of the two Starling-type resistors.

Consideration of this model suggests that if CVP in sitting patients is increased to a level sufficient to distend the intrathoracic veins, and not necessarily the jugular veins also, over their full length throughout the cardiac and ventilatory cycles, then air which enters the circulation via a venous sinus or emissary vein (site 1 in fig. 1) would collect preferentially in the neck rather than in the intrathoracic veins. Cardiac and ventilator induced swings in jugular venous pressure transmitted upwards through the air collection without hydrostatic loss would result not only in blood and bubbles being seen at the site of the open vein but also in the cessation of further air entry. There might be no passage of air to the intrathoracic venous system and heart, and I certainly believe that there would be no massive, sudden, life-threatening embolus.

On the other hand, air entering via the vertebral venous plexus (site 2 in fig. 1) may, in the film of the working model, continue to enter the venous system until the level of the air-blood interface progressively falls to reach first the intrathoracic veins and subsequently the heart. In this situation, although air will in theory reach the heart, it does not do so in a sudden, life-threatening manner.

Studies in upright sheep have shown that even small volumes of air which enter the venous system collect in part, at least in the great veins of the neck and upper thorax, and do not carry immediately cephalad and out completely to the heart [4]. What was interesting was that increasing RAP to a level of the order of 8 cm H₂O by infusion of 10 ml kg⁻¹ of plasma expander and the application of 10 cm H₂O of PEEP, did not delay air reaching the heart [4]. This was presumably a consequence of air which had collected in the intrathoracic veins being subject to the dynamics of venous pulsation and flow, and to the intermittent venous compressive effects of the inspiratory phase of IPPV.

The sheep studies also showed that when RAP is high before entry of air, the volume of air which can collect in the great veins of the neck and thorax is appreciable [3]. The studies also showed that RAP has to be markedly elevated before JBP is raised, except, and I stress except, where an appreciable column of air has collected in the venous system, so allowing pressure transmission upwards without hydrostatic loss [3].

Any readers who are of the view that humans are unlike sheep and that air perhaps does not collect in large volumes in the great veins of upright patients, I would refer to the fascinating historic article by Hewer and Logue [2]. These workers at the National Hospital for Nervous Diseases, Queen Square, London, under World War II fighter pilot G-suit in combination with an anaesthesia circle system with the anaesthesia reservoir bag (SVC) was represented by lengths of rubber dam, set up as an impressive sensitivity of children to this method of preventing venous air embolism may be drawn from the historic article of Hewer and Logue. It must be noted that in this report, the patient was breathing spontaneously. In these circumstances MAST could not achieve a constant increased RAP during the inspiratory phase of the respiratory cycle and moreover it could increase the negative inspiratory intrathoracic pressure and by increasing the work of breathing [2]. The question that should be addressed is: are children like human adults? A raised RAP and dural sinus pressure sufficient to prevent venous air embolism with the MAST suit and PEEP have been achieved in sitting adults by Schuurando, Payen and Beloulcif [3]. The main problems in preventing venous air embolism in adults are: how many subjects are sufficiently affected by this method of prevention; what level of RAP is adequate to raise dural sinus pressure above atmospheric pressure? and how long is this effect maintained [4]? Obviously in children, the short distance between the right atrium and dural sinuses is an advantage in avoiding hydrostatic loss and is probably the best explanation for the impressive sensitivity of children to this method of preventing venous air embolism.

Sir,—The working model representing the upright venous system is elegant and one of the main conclusions drawn from this study is that intrathoracic passage of air from open extrathoracic sinuses preferentially via the vertebral venous plexus in the upright position. Posterior cerebral venous drainage could be particularly important when the basal dural sinus pressure measure in the sitting position is only slightly negative, the drainage there being mostly dependent on vessels that are not affected by variations in RAP [1]. In humans undergoing surgery in the sitting position, this posterior drainage is probably affected significantly by anteroflexion of the neck with, in these circumstances, preferential drainage being via the anterior venous system.

I do not think that definitive conclusions regarding the efficiency of the MAST suit on prevention of venous air embolism may be drawn from the historic article of Hewer and Logue. It must be noted that in this report, the patient was breathing spontaneously. In these circumstances MAST could not achieve a constant increased RAP during the inspiratory phase of the respiratory cycle and moreover it could increase the negative inspiratory intrathoracic pressure and by increasing the work of breathing [2]. The question that should be addressed is: are children like human adults? A raised RAP and dural sinus pressure sufficient to prevent venous air embolism with the MAST suit and PEEP have been achieved in sitting adults by Schuurando, Payen and Beloulcif [3]. The main problems in preventing venous air embolism in adults are: how many subjects are sufficiently affected by this method of prevention; what level of RAP is adequate to raise dural sinus pressure above atmospheric pressure? and how long is this effect maintained [4]? Obviously in children, the short distance between the right atrium and dural sinuses is an advantage in avoiding hydrostatic loss and is probably the best explanation for the impressive sensitivity of children to this method of preventing venous air embolism.

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