LETTER

Pluronic-F68 and Venous Gas Emboli

To the Editor:

In their article (1), Jenssen and coworkers state that Butler and Hills (2) suggested that pretreatment with Pluronic-F68 would reduce the threshold for pulmonary passage of venous air emboli into the systemic circulation; however, that suggestion was never made. Instead, what was discussed was the role of surface tension in determining the displacement pressure of a gas bubble in a pulmonary capillary in terms of the equation of capillarity derived from Young and Laplace:

\[ \Delta P = 2\gamma \left( \frac{1}{r_1} - \frac{1}{r_2} \right) \] (1)

where \( \gamma \) is surface tension, \( \Delta P \) is the displacement pressure, \( r_1 \) is the radius of the bubble at the leading edge, and \( r_2 \) is the radius at the trailing edge. This equation applies if a thin, fluid film separates the bubbles from the endothelial surface and thereby avoids direct contact and a contact angle. Earlier investigators (3) used the surface-tension-reducing agents Antifoam A and B to manage coronary air embolism in dogs after coronary air injection. Another paper (4) evaluated use of Pluronic-F68 with venous air embolism in dogs in a protocol similar to that of Jenssen and coworkers.

The negative finding of Jenssen and coworkers, that there was no spillover of venous bubbles into arteries, is not surprising in view of the surface-tension effects, which was the logic behind the earlier studies. From the standpoint of adding Pluronic-F68 to lower surface tension (4), the amount given by Jenssen et al. probably was not sufficient. If the purpose was to reduce the diameter of bubbles, there is no evidence that the surfactant already available in the blood is insufficient to form very small bubbles. In fact, careful reading of another paper cited (5) does not indicate that addition of surfactant to plasma reduces bubble size; instead it indicates that addition of surfactant to isotonic solutions devoid of another surfactant material has an effect.

The addition of 1 ml/kg of a 5% Pluronic-F68 solution (1) probably caused little reduction of blood surface tension. Perry et al. (4) reported a 6.2 dyn/cm decrease for the same concentration, with large standard deviations. The change ranged from 3 to 13%, not likely to have much effect on the conditions for spillover as expressed in Eq. 1. Although Jenssen and coworkers suggest that local concentrations might have caused a large decrease in surface tension, this is not supported by experimental evidence.

In preliminary studies of the effect of Pluronic-F68 on venous bubble spillover in dogs receiving continuous venous air infusions (unpublished), we evaluated effects of dosage of 5% Pluronic-F68 on blood bubble tension to assure ourselves that there would be an effect. In fact, there was only a 7% decrease in surface tension between
control blood and blood with additions of 10, 20, and 30 ml of the solution. Because
the differences were so small and their expected effect on the spillover phenomena
predicted by Eq. 1 so inconsequential, we abandoned the study; the Jensson study
supports this decision.

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