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Letter to the Editor

The Influence of Vacuum Assisted Drainage on Arterial Line Emboli

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To the Editor,

We read with interest the article by Jones and colleagues entitled "How Effective are Cardiopulmonary Bypass Circuits at Removing Gaseous Microemboli" (1). Their invariable detection of gaseous microemboli (GME) distal to the cardiopulmonary bypass (CPB) arterial line filter after entrainment of air to the venous line is in complete agreement with our original report of the same phenomenon (2). We also acknowledge that their data shows that use of vacuum assisted venous drainage (VAVD) does not exacerbate this problem in all CPB circuits tested under their experimental conditions. However, the authors appear inexplicably reluctant to draw attention to the corollary, which constitutes an equally obvious and perhaps more important observation. Specifically, and in keeping with our previous report (2), the entrainment of venous air during VAVD in two of their five circuits was associated with numbers of arterial line GME that were at least an order of magnitude greater than recorded during gravity venous drainage (GVD). This finding may not have been emphasized because the mean numbers of arterial line GME detected during 65 mmHg of VAVD in the most clearly affected circuits (Terumo and Baxter) were low in comparison to those detected in the other circuits during either GVD or VAVD. However, it cannot be assumed that these emboli are trivial just because they are less numerous. Work from the authors' own department (3) has shown that exposure to similarly low numbers of cerebral emboli can adversely impact on neurocognitive outcome after cardiac surgery. We would also point out that statistical analyses of the differences between these highly variable counts in a study that used a small number of trials carries a high risk of Type II error and is probably unhelpful.

Perhaps more importantly, we believe that the method of entraining air into the CPB circuit in the Jones study was flawed. Specifically, air was introduced to the venous line at a restricted rate (T Jones pers comm.) that would not be influenced by the venous drainage technique. We used a "fixed volume / unrestricted rate" method of air entrainment (see Figure 1) and showed that VAVD

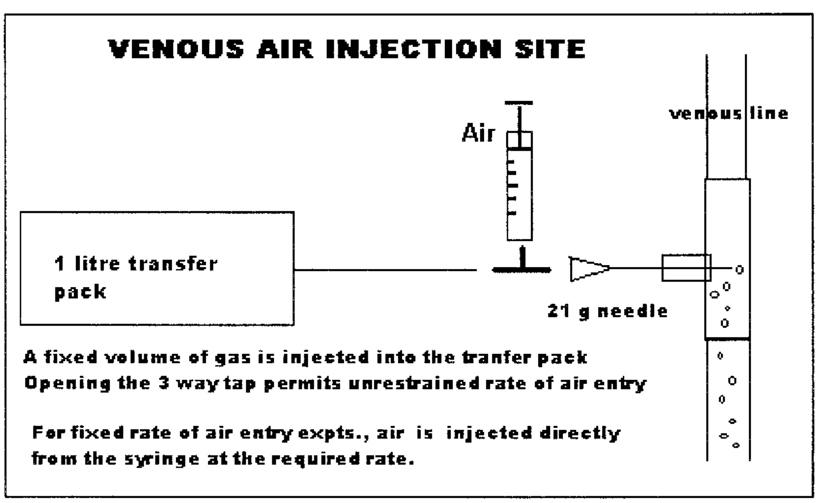

Figure 1. Venous air entrainment device for unrestricted rate of entry at fixed volumes.

caused a fixed volume of air to be entrained through a standard venous line leak at a faster rate than during GVD (2). This proved to be the pivotal influence on the consistently higher numbers of GME appearing in the arterial line during VAVD. When we introduced air at a fixed rate during VAVD and GVD the difference in arterial line GME numbers was vastly reduced. We maintain that the "unrestricted rate" method of air entrainment most closely approximates the clinical situation, and contend that the "fixed rate" method used by Jones et al. may have "protected" these circuits from the most deleterious influence of VAVD.

We reiterate our earlier warning that VAVD increases the number of arterial line GME when air is entrained to the CPB venous line.

REFERENCES

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