

From The Editor

Bubbles Bubbles Toils and Troubles

As any child knows dipping a circular wand in a mixture of soapy water creates a delightful myriad of bubbles whose “lighter than air” characteristics delight the observer. Chasing the bubbles becomes a game of unmatched proportions where the fruits of victory are found when the surface tension is disrupted by the intrusion of an unruly finger. Once again, the chase is on as escaping bubbles are tracked down to release their mystical powers. In the conduct of perfusion, painstaking efforts are employed to assure that these otherwise innocuous mysteries of physics do not wreak havoc in an fluid-filled environment.

Much work has gone into studying the effects of bubbles when they appear in the cardiovascular system. Anyone who has transcended the depths of the sea with a compressed cylinder of gas on their back can attest to the dangers of challenging the solubility of gas through rapid ascent. Hyperbaric chambers use this same technology to treat gaseous emboli, but more often, to improve the distribution of oxygen to otherwise poorly perfused tissue. Those of us utilizing extracorporeal devices are well aware of the importance in removing these potential emboli from priming solutions prior to initiating bypass, and in assuring that they do not appear throughout the procedure. Through both the publication of perfusion safety surveys and case reports we are well aware of the presence of this danger in our practices.

In the last issue of the *Journal* several papers from the Perfusion Innovations in Cardiac Surgery meeting of Key West Florida, reminded us of this very real threat to the safe conduct of perfusion. This issue contains a letter written by Tim Wilcox from Green Lane Hospital in Auckland, New Zealand and Simon Mitchell from Prince of Wales Hospital, Sydney, Australia. These authors were some of the first to warn us of the potential danger in utilizing augmented methods of venous return, with specific emphasis on the effects of venous sided negative pressure on arterial air emboli. Results from their laboratory were impressive, and scary, and were later confirmed by others in clinical reports. Methods of vacuum assisted venous drainage (VAVD) became popular over the past several years as techniques for minimally invasive surgery necessitated the incorporation of smaller cannulae, specifically on the venous side, to facilitate bypass.

Wilcox and Mitchell again caution those of us, including this writer, who employ methods of assisted venous return in our protocols. Their commentary on work presented by Jones and colleagues in volume 34, issue 1, question the conclusion as to the risk that such emboli impose. Jones looked at the air handling capacity of various commercially prepared perfusion circuits, and reported differences in air emboli retention in certain devices.

Indeed, it is well known that particulate emboli impose a more significant risk of injury than gaseous, yet quantification of degree of injury is all but impossible in controlled human studies.

A second important issue that needs to be addressed is emphasized in the paper by Almany and Sistino in this issue. These authors evaluated the safety of various venous reservoirs utilized for VAVD. They conclude, “positive pressure in the venous reservoir is a life-threatening event, which may take only seconds to harm a patient due to a massive venous or arterial air embolism”. This advice needs to be well heeded and methods that reduce the potential for catastrophe employed whenever a sealed hard-shell venous reservoir is employed with VAVD. Additional safety steps include, but are not limited to: the employment of a redundant positive pressure relief device such as a one-way flow valve attached to a port on the top of the venous reservoir, leaving an open recirculation line attached to an empty prime solution bag attached to a quick-prime port, constant measurement of the pressure within the venous reservoir with a pressure manometer with an audible alarm feature, and of course, heightened vigilance.

The danger of VAVD is once again emphasized by many of the manuscripts published in the *Journal's* first two issues of this year. Unfortunately, this remains a real problem that is unlikely to go away any time soon. With the significant advances that have occurred in perfusion safety during the past several decades, it is unacceptable to challenge the integrity of our circuitry for what may be minimal gain with questionable patient benefit. Although the demystification of bubbles in the cardiovascular system is unlikely to occur any time soon, avoidance becomes the better part of valor.

Sincerely,
Alfred H. Stammers, MSA, CCP
Editor