Letters

To the Editor:

Our attention has been called to the article "A Battle Plan in the Event of Massive Air Embolism During Open Heart Surgery" by William I. Brenner, MD, in Volume 17, Number 4 (Winter 1985) of the *Journal of Extra-Corporeal Technology.* Dr. Brenner is certainly to be congratulated for addressing efforts to react in what is one of the most serious accidents that can occur in and around an open heart operation. However, there are two aspects in his approach with which we differ.

First, in the event of massive air embolism into the systemic circulation we would strongly recommend the technique of retrograde perfusion. The technique[1] has been reported in its entirety and only recently another article supports its use in pediatric patients.[2]

Second, Number 13 in Dr. Brenner's battle plan advises avoiding profound barbiturate "artificial coma," and "suggests aim for early arousal, the best prognostic indicator." Recent studies indicate that this approach may not indeed be beneficial. In fact, the administration of sufficient thiopental to produce an isoelectric electroencephalogram may be recommended. Nussmeier et al presented clear data that patients who receive sufficient thiopental (avg. 39.5 mg/kg) to silence the EEG during CPB can reduce sensory motor neurologic dysfunction secondary to embolism in patients having true open heart procedures.[3] Barbiturate therapy did not appear to reduce the frequency of embolization but rather did reduce its clinical expression, presumbably by decreasing the size of the resulting cerebral infarction.

This study represents the first demonstration of cerebral protection by barbiturate in man. It was well done and has received recognition as such. Certainly patients receiving barbiturate therapy may be expected to sleep longer, may require more frequent inotropic support, and will need prolonged ventilation.

However, if true injury has occurred, the "aim for early arousal" is unrealistic. This approach is based on a false hope that everything will be OK. Only if there is no significant neurologic injury can early arousal be a reality. If indeed there is therapy (barbiturate coma) which can reduce or alleviate neurologic sequelae after massive air embolism, we feel it is to be indicated rather than avoided. We clearly realize the difficult period that all must undergo while awaiting the patient's response after thiopental treatment.

Finally, we would like to comment that step number 2, indicating the summoning of a backup perfusionist, in the event of trouble, is certainly warranted. However, at this time in the field of cardiopulmonary bypass which has become so complex and litigation prone, we recommend that a cardiopulmonary bypass operation should be performed with a second perfusionist or at least a perfusion assistant in attendance.

Noel L. Mills, MD

Head, Section of Cardiovascular Surgery

Donald E. Harmon, MD

Head, Section of Cardiovascular Anesthesiology
Alton Ochsner Medical Foundation
New Orleans, LA

Direct communications to: Noel L. Mills, M.D., Alton Ochsner Medical Foundation, 1516 Jefferson Highway, New Orleans, LA 70121

References

1. Mills, N.L. and Ochsner, J.L.: Massive Air Embolism during Cardiopulmonary Bypass. *J. Thorac. Cardiovasc. Surg.* 80(5) 707-717, Nov, 1980.
2. Stark, J. and Hough, J.: Air in the Aorta: Treatment by Reversed Perfusion. *Ann. Thorac. Surg.* 41:337-338, 1986.
3. Nussmeier, N.A. Arlund, C., R.N., and Slogoff, S.: Neuropsychiatric Complications after Cardiopulmonary Bypass: Cerebral Protection by a Barbiturate. *Anesthesiology* 64:165-1701, 1986.

Dear Mr. Riley:

I appreciate the opportunity to review the letter by Drs. Mills and Harmon in which they explain their differences with the "Battle Plan in the Event of Massive Air Embolism" I published in the *Journal* in 1985.[1]

Dr. Mills and his associates recommend the technique of retrograde perfusion to aid in purging arterial air embolism. Certainly the idea would appear to have merit. However, since no one institution should have a large experience with massive air embolism, Dr. Mills' experience and Stark's 1986 case report that he cites are

anecdotal in the same way. The successful outcome with anterograde perfusion in the case report I included in my 1985 paper was anecdotal as well. Good neurologic outcomes can result from both anterograde and retrograde perfusion. Stark refers to Hendriks' 1983 experimental study[2] in which only 47% of the injected gas bolus was removed from the circulation using retrograde perfusion. Since 53% was unaccounted for, Hendriks concluded that hyperbaric therapy should be used to supplement air purging although no data were provided to support this recommendation.

What is needed is a controlled prospective study comparing the efficacy of retrograde versus anterograde perfusion in purging embolized air. In the absence of clear data supporting either method the surgeon confronted by the crisis of massive air embolism should select the technique most suited to his team.

I recommended rapid deairing of the aorta, refilling the lines, and prompt resumption of conventional (anterograde) perfusion mainly for logistic reasons—namely to avoid further complicating an already chaotic situation with an unusual and unfamiliar perfusion practice.

With regard to induced high dose thiopental coma to treat cerebral air embolism, the Nussmeier paper referred to establishes the efficacy and rationale for barbiturate treatment by a prospective controlled study. It was published in 1986, again after my 1985 paper. After reading it I certainly would employ thiopental therapy should I encounter a case of massive cerebral air embolism again, and I thank Drs. Mills and Harmon for calling this important contribution to my attention.

Finally, I completely agree with Drs. Mills and Harmon that there should be two perfusionists present or immediately available during the conduct of an operation involving cardiopulmonary bypass. That is the current practice at the Kaiser Foundation Medical Center in Los Angeles.

I remember Dr. Mills as an astute and perceptive investigator from our NYU days as residents under Dr. Frank C. Spencer. I am honored to have caught his attention and enjoyed replying to his critique of my paper.

William I. Brenner, M.D.
Department of Cardiac Surgery
Kaiser Foundation Medical Center
Los Angeles, CA

References

1. Brenner, W.I.: A Battle Plan in the Event of Massive Air Embolism during Open Heart Surgery. *J. Extra-Corpor. Tech.* 17: 133-137, 1985.
2. Hendriks, F.F.A., Bogers, A.J.J.C., Aart Brutel de la Riviere, et al. The Effectiveness of Venoarterial Perfusion in Treatment of Arterial Air Embolism during Cardiopulmonary Bypass. *Ann. Thorac. Surg.* 36: 433-436, 1983.

To the Editor:

I was approached by one of our anesthesiologists concerning articles printed in the latest *Anesthesiology* journal, regarding the reaction of liquid Forane and polycarbonates.[1,2] Evidently, their vaporizers are directly over the oxygenator, the Bentley-10 in this case. While filling the vaporizer if accidental spillage occurs onto the shell of the oxygenator, it becomes grossly cracked. These results were duplicated in our institution, post pump run, to see the results ourselves, using Forane and an Integral Filter Cobe Membrane Lung. The results were similar and quite impressive.

This, I believe, is an accident waiting to happen. While I am glad our hospital employs an anesthesiologist that stays abreast of current literature, I felt uneasy knowing that hundreds of perfusionists, using volatile agents while on bypass, were not aware of this potential problem.

I called a large open heart institution where I used to work, to see if they were aware of the potential problem or to see if I were totally oblivious to an old problem. Much to my surprise, they were not aware of this problem, which led me to wonder: if a large institution is not aware, how many smaller institutions, like our own, need to be made aware?

I felt that the only way to properly expose this sort of problem would be to submit this letter to where it belongs, in *Perfusion Life* or *The Journal of Extra-Corporeal Technology*. I hope you will consider it, if you have not received it already.

Thank you,

Victor Carcioppolo

1. Maltry, D.E. and Eggero, Jr., G.W.W., Letter: "Isoflurane—induced failure of The Bentley-10 oxygenator." *Anesthesiology*, 66: 100-101, 1987
2. Cooper, S. and Levin, R.: Letter: "Near Catastrophic Oxygenator Failure," *Anesthesiology*, 66: 101-102, 1987

continued, page 236

continued from page 199

To the Editor:

I believe that you and our fellow perfusion practitioners will find two letters recently published in a medical journal as instructive and alarming as we did here in Green Bay. In the January 1987 (vol. 66, no. 1, pgs. 100-102) issue of *Anesthesiology*, two separate letters to the editor report several instances of catastrophic fragmentation and structural failure of at least two different oxygenators when they were inadvertently brought into contact with small amounts (a few drops to 1 ml.) of liquid Isoflurane (Forane). The pictures submitted along with the letters were quite dramatic, showing the top of a Bentley BOS-10 which looked as if a large hammer had been applied to it, and a Shiley M-2000 with its arterial outlet port nearly severed from the body of the oxygenator! Both events occurred during the bypass, necessitating the interruption of cardiopulmonary bypass while the oxygenator was changed.

While many of us have seen the effects that Halothane on polycarbonate pump head covers, this is the first reference I have seen to anything more than cosmetic damage to polycarbonate components, which make up a large percentage of any CPB circuit. Fascinated, we undertook some informal experimentation of our own, using some previously opened but unused components. Applying a few drops to both the tops and sides of Bentley and Cobe cardiotomy reservoirs produced no apparent effect. However, when the Forane was applied to a Cobe IF-CML, the results were quite unique and dramatic, but variable, depending on the part of the oxygenator tested. When the anesthetic was dripped onto the top of the CML, it seemed at first as if nothing had happened. There was no softening of the plastic, and the liquid quickly evaporated, leaving a dry, hard surface. A few seconds later, as we watched in awe, several long transmural cracks appeared in the top, and advanced before our eyes at the rate of over 1cm/sec. Within seconds, the top was fragmented! The effect was similar but less dramatic on the clear reservoir housing. One can only shudder to think what this would be like with a patient on bypass!

I would encourage everyone both to look up these letters and try the experiment on discarded or unused polycarbonate products of every manufacturer. I also believe that the perfusion community should pressure the manufacturers to include this possible effect on their warning labels, considering the potentially catastrophic outcome.

Sincerely,

James W. Cooksey, C.C.P.
Green Bay, Wisconsin

Dear Readers:

The Editors of the *Journal of Extra-Corporeal Technology* wish to thank you for your support throughout the 1986-1987 Volume 18 year! The Editors want to take this opportunity to thank AmSECT's President and Board of Directors, and The Cate Corporation Staff, especially, Ms. Shirley Nuhn, for sponsoring and supporting our efforts to improve and expand the *Journal*.

You have noticed that the *Journal* has taken on a more professional and effective content and appearance with the highlighting of the Abstracts, the addition of keyword assignments, and the *Journal* reference inclusion in the Abstract. Reader, Associate Editor, and author participation is at an all time high with timely submission and processing of manuscripts and "Letters to the Editor" to keep the *Journal* interesting and on schedule.

A list of keywords has been included in Issue #4 to give future and past reference to *Journal* published articles. The Editors of the *Journal* have been working in cooperation with Mr. Gary Reeder to complete a computer data base that includes retrievable author, title, keyword, and abstract information for the complete library of *Journal*. The development of the *J. Extra-Corpor. Tech.* computerized literature search capability will increase the likelihood that the body of perfusion knowledge in the *Journal* will be referenced by new authors, other allied health professionals, and medical specialists.

The current Editors want to especially thank the previous Editors for their years of unselfish dedication and hard work to make the *Journal* the success that it is today.

Thank you for your continued support. Let's continue to increase the frequency and quality of the scientific communication within our profession and our medical peer groups.

Jeffrey B. Riley
Editor