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Commentary

Since the 1970s, leukocytes have been shown to play a causative role in neurologic injury, particularly after ischemia. Indeed, in the early 1980s, much research effort was devoted to negating leukocyte-mediated injury by the administration of superoxide dismutase to combat free oxygen radicals, steroids to reduce inflammation, and agents to prevent other harmful effects. In our own research, trying to prevent spinal cord reperfusion injury after aortic crossclamping, we tried superoxide dismutase and allopurinol. Our results showed that the animals appeared to be more hemodynamically stable, and stress ulceration in the stomach was absent, but spinal neurologic injury was not prevented. More recently, the Johns Hopkins University group and others have shown that leukocyte filtration is effective in reducing myocardial and pulmonary injury after ischemia and also in reducing reperfusion injury in transplanted organs.

In this study Rimpiläinen and colleagues present their results after using a leukocyte filter during cardiopulmonary bypass (CPB) in animals undergoing 75 minutes of circulatory arrest. They found that filtration resulted in a lower mortality rate, better behavioral recovery, and less histologic evidence of brain injury. Although exclusion of the early deaths in the control group did not result in a significant difference in behavioral or histologic scores, there nevertheless was a trend toward better neurologic outcome for the filtered animals (behavioral score, $P = .08$; histologic score, $P = .08$).

Although not discussed in the authors' study, filtration may also have other benefits apart from leukocyte removal, particularly because they noted little effect on proinflammatory cytokines (ie, tumor necrosis factor α, interleukin 1β, and interleukin 8). Microfiltration alone, without leukocyte depletion, has been known to be beneficial for a long period of time, and with increasing evidence of microgaseous and particulate emboli affecting postoperative neurocognitive function, the authors may have filtered out other potentially harmful material, including emboli, particularly because the pump times were long. Clinical studies have shown that with hypothermic arrest, the pump time is a strong predictor of stroke and neurocognitive deficit.

Should filtration therefore be used in the clinical setting, particularly for cardiac operations requiring prolonged CPB? This study, other animal studies, and the randomized study from Emory would suggest that there is a benefit to arterial leukocyte filtration, although the Emory study failed to show a neurologic benefit. Ideally, a large clinically prospective randomized study, including assessment of neurocognitive function, should be done to answer the question of benefit. The one potential drawback with leukocyte filtration is that platelet levels are reduced, although this can be prevented by prebypass plasma pheresis, which is the method we use to reduce the loss of platelets with filtration. Thus, since December 1993, we have routinely used this same leukocyte-depletion filter for patients undergoing ascending aorta or aortic arch operations, including deep hypothermia and circulatory arrest. In 276 such patients, the stroke rate has been 2.9% (8/276; 30-day mortality, 1.8% [5/275]). Although we do not have a concurrent comparative group, compared with historical patients, it is our impression that postoperative cardiac dysfunction, *pump lung*, multiple organ failure, and neurologic injury have been reduced, particularly subtle forms, including neurocognitive deficits. This is supported by a recent prospective randomized study we did with neurocognitive evaluation. Clearly, other factors have also contributed to improved results. Nevertheless, we endorse the more frequent use of arterial leukocyte filtration for prolonged CPB times.

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