Anesthetic Requirements Decrease after Cardiopulmonary Bypass

To the Editor—In a recent report by Antognini1 goats anesthetized with isoflurane were noted to have a reduction in minimum alveolar concentration (MAC) (following cardiopulmonary bypass employing hypothermia and subsequent rewarming to 37°C) of approximately 20%. The author speculated that various properties related to hypothermia may explain the difference in isoflurane MAC before versus after cardiopulmonary bypass. We would like to offer another explanation, that MAC was reduced because of an effect related to cardiopulmonary bypass itself independent of any effect due to hypothermia. We previously have shown in the dog that enflurane MAC was reduced after normothermic cardiopulmonary bypass.2 Subsequent investigation has shown that, in a partial-bypass model in the dog, this effect was independent of the role played by hypothermia and changes in arterial carbon dioxide concentration.3 Although Antognini and Kien could not replicate our initial results,4 the study by Antognini has demonstrated a difference in anesthetic requirements before versus after cardiopulmonary bypass. Taken together, the results suggest that MAC reduction following cardiopulmonary bypass is species-independent, agent-independent, and temperature-independent. Clearly, there is variability in the observation even when performed by the same investigator. What remains to be explained is the mechanism for the reduction.

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References
1. Antognini JF: Hypothermia eliminates isoflurane requirements at 20°C. ANESTHESIOLOGY 78:1152–1156, 1993
4. Antognini JF, Kien ND: Cardiopulmonary bypass does not alter canine enflurane requirements. ANESTHESIOLOGY 76:953–957, 1992

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In Reply—Although the 20% minimum alveolar concentration (MAC) reduction seen in my study1 was not the principal finding, it raises an important question now addressed by Hall and Sullivan: Does cardiopulmonary bypass (CPB) alter MAC? Their interpretation of the various studies1–4 is that MAC reduction after CPB is species-, temperature-, and agent-independent and therefore is due to CPB. Unfortunately, there are many confounding variables, so that simply adding the studies together may not result in a valid conclusion. A MAC reduction seen after CPB may be fleeting, and other variables (e.g., hypothermia, duration of bypass) may accentuate or attenuate this manifestation. For example, differences in the CPB prime might explain the discrepant results, because Piasmalyte, which was used in the Hall and Sullivan1 study, contains acetate, which lowers MAC.5 Furthermore, because acetate is metabolized quickly, its effect would be transient.

Taken together, I think that the results of these studies do not clearly answer the question, and further work is necessary.

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