ventilation in the face of insufficient fresh gas flows with the Bain circuit (resulting in profound rebreathing) is a more plausible explanation for the exceptional PETCO₂ described in this Clinical Report.

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- 2 Andrews JJ. Anesthesia systems. In: Barash PG, Cullen BF, Stoelting RK (Eds.). *Clinical Anesthesia*. New York: Lippincott, 1989: 531–3.

REPLY

I thank Drs. Mezon and Badner for their thoughts on the case, but I don't think diminished gas flow in the face of increased minute volume explains the rapid hypercarbia. Firstly, within 15 min the PETCO₂ increased from 32 to 45 mmHg without alteration of ventilation or fresh gas flow. Secondly, I have never seen a doubling of PETCO₂ simply by increasing the minute volume without augmenting the fresh gas flow.

To test Drs. Mezon and Badner's hypothesis, I conducted a trial simulation during an anaesthetic given to a stable 79-yr-old woman undergoing mastectomy. She was given a general anaesthetic with tracheal intubation and mechanical ventilation delivering nitrous oxide, oxygen and Forane. After increasing her ventilator settings from respiratory rate 10/tidal volume 800 ml to RR 20/VT 1000 ml and decreasing N₂O/O₂ from 4/2 L·min⁻¹ to 3/1.5 L·min⁻¹ for 20 min, her PETCO₂ only changed from 36 to 38 mmHg. This does not appear to be a large effect and does not explain the dramatic hypercarbia changes seen in the case I presented.

However, I do agree that increasing fresh gas flow would assist in the elimination of CO₂ and this may be more important when using the Bain circuit.

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The diving reflex: bradycardia during cold ocular irrigation

To the Editor:

We read with interest the informative article by Drs. Arndt and Stock regarding the concern of bradycardia during cold ocular irrigation under general anaesthesia.¹ We wish to share our experiences regarding this issue. As Arndt describes, classically the diving reflex causes

bradycardia without hypotension during the application of cold irrigants to the distribution of the ophthalmic division of the fifth cranial nerve.² Bradycardia is then mediated through the vagus nerve. In man, this trigeminal-brainstem vagal function is initiated by application of 0–20°C cold saline to the face.^{2,3} Both the cornea and the iris are supplied by myelinated afferent nerve fibres from the ophthalmic division of the fifth cranial nerve. One would expect that if a cold irrigant solution were applied to the iris, in isolation of the cornea, the diving reflex would occur. This, however, does not appear to be the case.

At our institution a "topical" anaesthetic technique is currently being used for cataract surgery. In this technique the patient's cornea is anaesthetized topically with a solution of 0.75% bupivacaine. This blocks all afferent input to the trigeminal nerve from the corneal surface. During surgery, cold irrigant solution (4°C) is used to irrigate the anterior chamber. During the irrigation the iris afferent supply remains unblocked and thus is being excited by the cold irrigant. One might expect the diving reflex to occur. However, since the original article by Drs. Arndt and Stock (June, 1993) 300 patients have been managed in this way with no noted episode of bradycardia or arrhythmias. The only adverse effect noted is that the patient describes slight ocular discomfort during cold irrigation. We are currently prospectively documenting the patient's pulse rate immediately before and during cold irrigation.

Although the diving reflex is an apparent theoretical concern during cold irrigation in a "topical" anaesthetic technique, it does not appear to be of clinical significance. This leads us to question as to whether the case of bradycardia during anaesthesia as described by Arndt and Stock was a true example of the diving reflex. One might conclude that while the "watertight drape was placed around the left eye and the surgeon began to irrigate the eye liberally with sterile, room temperature (19.7°C), normal saline," pressure was applied to the periocular structure thus initiating an oculocardiac reflex rather than a diving reflex.

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