

The manufacturer is aware of this shortcoming† and plans to incorporate an adjustable high pressure alarm in its forthcoming Narcomed 3™ anesthesia machine but not in its separate anesthesia ventilators. Until fail-safe ventilator alarms become available, patient safety

† Horsfield T: Personal communication, North American Drager.

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In reply:—The letter by Dr. Bashein, and Dr. MacEvoy raises the following three questions: 1) Is a high-pressure alarm an adequate device to reveal an occluded breathing system? 2) Under what conditions should alarm sensing points be made adjustable? 3) Should the maximum ventilation pressure in the anesthesia breathing system be adjustable?

1) A safety device that becomes active in only a certain percentage of the critical incidents but does not respond to all of the critical incidents will introduce a false sense of security and may be more dangerous than not having a safety device at all. In some instances, an occluded patient breathing system may be accompanied by the occurrence of an excessive high pressure in some sections of the system (if the occlusion occurs during artificial ventilation, and ventilator settings, equipment compliance, and preset tidal volume permit the generating of an excessive high pressure); however, the occurrence is not always accompanied by an excessive high pressure (for example, when the patient breathes spontaneously or when the above-referenced parameters are such that they do not produce an excessive high pressure during artificial ventilation). In light of the above, it can be stated that an excessive high pressure does not necessarily accompany the occurrence of an occluded system. Therefore, high-pressure alarms cannot be recommended for use as monitors to determine the occurrence of an occluded system. This has been pointed out on pages 30, 36, 52, 53, 54, and 55 in the Safety Guidelines published and distributed by North American Drager. It is stated on page 36, “. . . a pressure monitor is not designed to warn of occlusions or misconnections in the breathing system and should not be relied upon for that purpose.” Due to the fact that an occluded system interrupts gas flow and, in most cases, separates the patient from the machine, the only monitoring devices that will reveal the occlusion of a system are monitors that measure respiratory flow in the system or changes of CO₂ concentrations at the patient's airways.

continues to depend upon a vigilant anesthesiologist and an esophageal stethoscope.

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The problem addressed above has been thoroughly discussed in North American Drager's Safety Guidelines for Anesthesia Systems, which has been distributed to all users of North American Drager anesthesia machines.

2) An anesthesia system, as it is used in the operating room today, including the various monitors, incorporates up to and, in many cases, in excess of 50 possible, different alarm messages. At the present time, the proliferation of alarm signals in the operating room represents one of the most immediate problems manufacturers of anesthesia machines and suppliers of monitors have to address. The amount of equipment set-up time required at the beginning of a procedure would be prohibitive if all of the alarms were adjustable. It is known that a hazard can be introduced in many instances by using adjustable alarm levels rather than fixed alarm points (adjustable pressure setting for disconnect alarms). It is a challenging task for a manufacturer to decide which of the alarms shall be adjustable and which of the alarms shall be preset. However, it should be known that no manufacturer takes this task lightly. Consultations are made with physicians and users of the equipment, and the final decision to make an alarm adjustable or not adjustable may be disputed.

3) The maximum ventilation pressure in the system may be adjustable in some ventilators. This is the result either of a customer's request for adjustability of the maximum ventilation pressure or the result of the design of the flow adjustment device in the ventilator. Whatever the reasons may be, a limitation of the ventilation pressure in the system is a desirable safety feature that should not be disputed for the benefit of making a high-pressure alarm the tool to reveal an occluded breathing system when the high-pressure alarm was not designed nor advertised for that purpose.

Conclusion: It is important to remember that medical devices should only be used for the purpose for which they are designed. Such purpose is described in the instruction material accompanying the device. This in-

cludes high-pressure alarms, which are designed solely to reveal the existence of a dangerous high pressure in the system but not to reveal any other hazardous condition that may or may not be accompanied by high pressure.

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Antiarrhythmic Effect of Verapamil May Be Independent of Calcium Channel Blockade

To the Editor:—Kroll and Knight demonstrated that verapamil, halothane, enflurane, and isoflurane each significantly reduced ventricular fibrillation in an occlusion-reperfusion arrhythmia model.¹ Because of verapamil's well-defined action as a calcium entry blocker and the ability of the volatile anesthetics to modulate calcium ion translocation, they suggested that blockade of calcium channels was the probable mechanism for each drug's antifibrillatory effect. Lynch's accompanying editorial² emphasizes that volatile anesthetics may exert their antiarrhythmic effect by actions other than by calcium channel blockade. However, verapamil's heterogeneity, too, should not be overlooked, for it possesses many effects, other than calcium channel blockade, which could be antiarrhythmic in this setting.³ Kroll and Knight have convincingly discounted some of these properties (*e.g.*, fast-channel blockade) for verapamil's antiarrhythmic action, but others, including its alpha-adrenergic blocking properties,⁴ were not addressed. Using a feline occlusion-reperfusion model, Corr's group have established the antiarrhythmic effect of alpha₁ adrenergic blockade.⁵ Consistent with this pharmacologic effect, the myocardial alpha₁ adrenoceptors density was significantly increased during the occlusion and early reperfusion period.⁶ Verapamil also has been shown to raise the arrhythmia threshold in a canine halothane-epinephrine arrhythmia model⁷ in which the mediating mechanism is predominantly the alpha adrenoceptor.⁸

Thus, in Kroll and Knight's study, the antiarrhythmic effects of verapamil and volatile anesthetics may be operating through entirely different mechanisms, *both* independent of calcium channel blockade.

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The Diagnosis of "Junctional Rhythms" with Halogenated Anesthetics

To the Editor:— We have read "Successful Treatment of Accelerated Junctional Rhythm with Propranolol: Possible Role of Sympathetic Stimulation in the Genesis of this Rhythm Disturbance"¹ with interest.

We question whether this may be a case of isorhythmic dissociation (ID)^{2,3} rather than the accelerated nodal rhythm reported, since, as pointed out by Sethna *et al.*,⁴ ID is common during inhalational anesthesia but often