CORRESPONDENCE

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Accidental Disconnection and Pulmonary Barotrauma

To the Editor:—Injuries to patients have occurred as a result of accidental disconnection of the patient from the breathing system and less commonly, from exposure of the patient to sudden very high pressure or excessive pressure maintained for a prolonged period of time.

In the past, anesthesia ventilators have incorporated a disconnection alarm or a separate accessory alarm has been made available by the manufacturer, though in several instances the alarm failed to alert the user to the disconnection.[1,*] Most alarms were not designed to warn of excessively high pressure, although recently, an improved alarm has been introduced which does so.† This excessive pressure may arise from one of several means: 1) from accidental activation of the O_2 flush which may rupture the lungs before the patient can be disconnected; 2) from a prolonged period of increased pressure from incorrect connection of the patient to a ventilator; 3) failure to properly adjust the pressure relief valve; and 4) faulty operation of the scavenging system. In these instances it is desirable that in addition to sounding the alarm, the safety device should open the breathing system promptly to permit the pressure to fall to atmospheric. However, if the system remains open, an apneic patient could then become anoxic unless an alert attendant quickly responds to the emergency.

The following specifications are proposed, therefore, for a combined alarm-safety mechanism to be fitted to the anesthesia apparatus: 1) It should detect the absence of normal pressure fluctuation in the breathing system‡ and sound the alarm, like present disconnect alarms. 2) If the pressure in the breathing system exceeds 30 cmH_2O§ for longer than 5 s,§ the device should release the pressure and sound the alarm allowing the breathing system pressure to fall to 1 cmH_2O and remain there for 5 s before closing the system again and allowing the pressure to build up to 30 cmH_2O before opening it once more, thus providing artifical respiration at a slow rate all the time sounding the alarm. 3) If the pressure in the breathing system ever exceeds say 50 cmH_2O, the alarm shall sound and the mechanism shall release the pressure and allow it to fall to 1 cmH_2O. After a 5-s pause, it should then close the valve, again opening it once more when the pressure reaches 30 cmH_2O and repeating the cycle, thus providing artificial respiration, and again continuing to alarm until reset by the operator. 4) Activation of the high pressure alarm and pressure relief mechanism of the device should be automatic with switching on of the flow of anesthesia gases. The disconnect alarm should become operative automatically with switching on of the anesthesia ventilator. 5) A mechanism should be provided to mute the audible alarm for a period of two minutes for airway suction, etc. 6) The pressure should be sensed within the breathing system, close to the point at which the fresh gas enters the breathing system. The pressure sensing and time delay mechanism could be either fluidic or electronic in operation.

This alarm-safety mechanism is proposed to help prevent such accidents that have been the subject of legal suits in the past. Comments and suggestions would be welcomed.

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* Medical Device Alert No. 30. Pressure hysteresis in the Monaghan/Hospal Model 703 ventilator alarm. Health Protection Branch, Health and Welfare, Canada. October 23, 1980.

† North American Drager DPM-S multi function monitor.

‡ McEwen JA, Small CF, Jenkins LC: A smart disconnect monitor for anaesthetic equipment. Digest of the Eighth Canadian Medical and Biology Engineering Conference, 1980, pp 120–121.

§ This pressure and time may prove to be less than optimal and it may be desirable to fit an over-ride mechanism to permit re-expansion of the collapsed lung at the end of the thoracotomy.

REFERENCE

1. McEwen JA, Small CF, Saunders BA, Jenkins LC: Hazards associated with the use of disconnect monitors. ANESTHESIOLOGY 53:S391, 1980

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