but to no avail. In the meantime, the authors published a similar article in the journal Respiratory Care 1987; 32: Our response to the clinical community has been slow to evolve since communication with the authors has proved unsuccessful to date.

Siemens-Elema would like to point out that the SV 900C has been marketed worldwide since 1981 and has an established clinical track record. The comprehensive safety features incorporated into the design of the SV 900C allow it to be recognized as one of the dominant ventilators used in critical care. Our concern is with how the allegations presented in the Chest article relate to actual clinical practice. Siemens-Elema has therefore found it necessary to issue a rebuttal clarifying the performance features of the SV 900C.

Value characteristics

The authors claim that all expiratory pressure valves can be classified into either threshold or flow resistors. They also state that the expiratory valve in the SV 900C functions as a flow resistor with an adjustable orifice which relates to the preset pressure set for CPAP/PEEP. This is fundamentally wrong. The expiratory valve of the SV 900C is not a flow resistor valve. It is a servo-controlled valve. To control CPAP/PEEP levels, it is regulated to open or close according to preset values and input signals from the inspiratory flow transducer, as well as from the inspiratory and expiratory pressure transducers.

Test methods

We are very concerned with the theoretic assumptions for selecting a test flow rate of 200 L/min to simulate a cough reflex in an intubated patient. Physiologically, these patients have problems generating high flow rates since the glottis has been bypassed. Also, the resistance of the entire breathing circuit must be taken into account, especially the resistance offered by the endotracheal tube.1 Finally, the bench test procedure contains several undefined criteria such as the specific duration of time in which the peak flow was delivered, measured tidal volume during each expiratory cycle, and selection of a sinusoidal flow generator to mimic a cough maneuver.

Test procedures

The SV 900C is designed with a servo feedback control system for regulating the various modes of ventilation. This Servo control system involves integrated measuring and regulating devices which interact with each other to accomplish the desired ventilatory pattern and mode of ventilation. The SV 900C incorporates several comprehensive safety functions designed for protection of the patient, as well as device failure.4 Separation of the ventilator breathing circuit or isolation of individual components as described in the test procedures are not recommended by the manufacturer. For clinical use, the instructions in the operating manual must always be followed. Test set-ups for calibration or functional checks other than recommended in the operating and service manuals may result in disabling control or safety functions.

Test result

We have been unable to reproduce the data presented in this article because of the unclearly defined test methods. However, the maximum pressure drop over the entire expiratory limb (Y piece to expiratory outlet) of the SV 900C breathing circuit is definitely lower than presented in this article. To quantify the actual pressure drop at specified flow rates, we have performed tests by means of a simplified test method. This test method consists of measuring the pressure drop at a constant flow through the entire expiratory limb with the expiratory valve in a fully open position. This test set-up will approximate the situation that would occur in a clinical situation where exhaled flow suddenly increased. In the clinical situation where exhaled flow rate suddenly increases, with the upper pressure limit properly set, the maximum time interval for the expiratory valve to fully open would be less than 40 ms.

<table>
<thead>
<tr>
<th>Flow rate (LPM)</th>
<th>Pressure drop (cm H2O)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>7</td>
</tr>
<tr>
<td>100</td>
<td>15</td>
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<tr>
<td>120</td>
<td>20</td>
</tr>
<tr>
<td>200</td>
<td>60</td>
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</table>

We feel our results (Table) are significantly less when compared to the data presented in the Chest article. We conclude that the disparity with the reported data may be the result of inappropriately designed test methods and conducted test procedures. The clinical significance of the SV 900C in minimizing the overall work of breathing has been well documented in the literature.5

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REFERENCES
3 Katz JA, Kraemer RW, Gjerde GE. Inspiratory work with continuous positive airway pressure delivery systems. Chest 1985; 519-26
4 Capps JS, Ritz R, Pierson DJ. An evaluation in four ventilators of characteristics that effect the work of breathing. Respir Care 1987; 1017-24

To the Editor:

Thank you for the opportunity to respond to Mr. Olsson's comments on our paper.2 Threshold resistors and flow resistors are generic types of expiratory positive pressure valves. Commercially available expiratory positive pressure valves may be classified as one of these types or may be a hybrid and have characteristics of both (ie, inflatatable balloon or mushroom valve). Threshold resistors generate pressure (P) by exerting force (F) over a discrete surface area (SA), Pa/F/SA. Flow resistors generate P by the product of resistance (R) and flow rate (V), PaRV. It is correct that the expiratory positive pressure valve on the Siemens 900C ventilator is a servo controlled valve, but that in and of itself does not preclude the valve from exhibiting flow resistor-like or threshold resistor-like characteristics. A review of Mr. Olsson's data illustrates this point. On the following Figure, the pressure drop and flow rate data for the Siemens expiratory positive pressure valve (furnished by Mr. Olsson) and comparable data for a low flow-resistant threshold resistor (Vital Signs Inc, Totowa, NJ) are plotted. We measured the pressure drop across a 5 cm H2O vital signs valve using the same protocol as Mr. Olsson. The greater the slope of the line, the greater the resistance of the valve, and vice versa. An ideal flow resistor demonstrates a linear increase in pressure as flow rate increases and therefore, has a constant slope on a pressure-flow rate plot. In contrast, an ideal threshold resistor should not demonstrate variations in pressure as flow rate increases. The Siemens expiratory positive pressure valve has higher flow-resistant characteristics than the lower flow-resistant threshold resistor valve. Clearly, the Siemens valve responds more as a flow resistor than a threshold resistor. It is also interesting to
note that the Siemens valve was set in the "fully open" position when the measurements were performed; had the system been set to generate continuous positive airway pressure (CPAP), the observed pressure drop data may have been higher (i.e., greater resistance across the valve). The Hamilton Veolar ventilator (Hamilton Medical Inc, Reno, NV) also has a servo-controlled expiratory pressure valve that operates and responds as a low flow-resistant threshold resistor.4

Concerning the test methods used, intubated subjects can generate peak exhaled flow rates up to approximately 270 L/min during coughing.2 Peak exhaled flow rates during simulated coughing with endotracheal intubation ranged from 50 to 200 L/min in our study. We evaluated the resistance characteristics of a variety of expiratory positive pressure valves using a sinusoidal flow waveform, since intubated patients do not cough with a constant flow waveform.3 Expiratory time and volume were not evaluated since the key independent and dependent variables were exhaled flow rate and the pressure drop across the valve, respectively. Evaluating resistance (pressure drop and flow rate) of expiratory positive pressure valves was the objective of the study. All ventilators were studied intact; no components were isolated during testing. The methods used are clearly described in the paper.

Mr. Olsson was unable to reproduce our findings because his evaluations were performed differently from ours. First, he used constant flow rates (a nonphysiologic application), while we used sinusoidal flow rates. Second, he tested the Siemens expiratory positive pressure valve in the fully open position with no CPAP while we examined the valve with CPAP at various levels. A fully open valve offers less resistance to flow than one that is set to provide CPAP. Increased resistance with increasing levels of CPAP have been reported with the Siemens expiratory positive pressure valve.45 As described earlier, since PdV̇, as R increases and V̇ is not changed, P must increase. For these reasons, his data (pressure drop) are lower than ours.

Our study was designed appropriately to determine the flow-resistive characteristics of a variety of expiratory positive pressure valve systems during simulated coughing. Work of breathing was not reported in our study and, therefore, is not germane to this discussion.

REFERENCES

Liver Involvement in Acute Q Fever

To the Editor:

We have read with interest the recent report by Marrie et al (Chest 1988;93:98-103) concerning the epidemiologic investigation of an outbreak of Q fever, and we would like to add some comments on the apparent lack of liver involvement in the patients reported in the article.

Although Q fever is considered primarily a respiratory disease, hepatic dysfunction is common in C. burnetti infections, either in epidemic or sporadic cases.14 Symptoms related to liver involvement...