Communications to the Editor

Communications for this section will be published as space and priorities permit. The comments should not exceed 350 words in length, with a maximum of five references; one figure or table can be printed. Exceptions may occur under particular circumstances. Contributions may include comments on articles published in this periodical, or they may be reports of unique educational character. Specific permission to publish should be cited in a covering letter or appended as a postscript.

Esophageal Perforation
The Need for Early Diagnosis

To the Editor:

In a recent study, Graeber et al reported esophageal perforations and suggested that, regardless of etiology, these perforations could be successfully treated with low mortality rates using surgical treatment. We recently observed an 83-year-old woman admitted to the hospital with massive subcutaneous cervico-facial and thoracic emphysema associated with partial cardiac tamponade. Her recent history was remarkable for routine ambulatory gastroscopy 36 hours before. Since that time she developed progressive dyspnea and chest pain. X-rays examinations (including gastrografin swallow) confirmed perforation of the distal third of the esophagus with massive mediastinal emphysema. After early resuscitation, surgical treatment consisted of esophageal leakage closure and mediastinal and right pleural drainage. Recovery was eventless and the patient was discharged 28 days after admission. Esophageal perforation, regardless of etiology, remains a misdiagnosed digestive tract perforation. Perforation rate is less than 0.01 percent with flexible esophagoscopy but wider use of this procedure has increased the frequency of instrumental perforation. Wesdorp et al reported a 0 percent mortality rate in a series of 19 non-malignant patients presenting with instrumental perforation who were treated with conservative management. It should be noted that delay in diagnosis was less than three hours. Nonoperative management is not safe when delay in diagnosis is more than 12 hours. Surgical management is always required regardless of the age and associated medical problems when shock, sepsis or massive subcutaneous emphysema and compressive mediastinal emphysema are noted. Delay in treatment could lead to cardiac tamponade and rapid fatal issue. Etiology of perforation and treatment modalities don't have the prognostically decisive influence of delay in treatment. It is vital that esophageal perforation is diagnosed as soon as possible to avoid complications requiring aggressive treatment. In esophageal instrumentation, close surveillance should avoid delay in diagnosing perforation.


REFERENCES

To the Editor:

As Dr. Meyer and associates pointed out, we share their enthusiasm for surgical therapy, but in certain instances we also have achieved success with intensive medical therapy alone. He cites a study by Wesdorp and associates noting that 19 patients who presented with esophageal perforation were successfully treated by conservative management. None of those 19 patients had malignancy in the esophagus at the time perforation occurred, and the diagnosis was made within three hours of perforation. Early diagnosis is beneficial for successful treatment of esophageal perforation and is particularly important in those patients who are being managed conservatively. Any evidence that conservative therapy is failing should prompt immediate operative intervention to correct what is destined to become a lethal condition.

I thank Dr. Meyer for his comments and concurrence with our thoughts. I congratulate him on his success in treating an elderly patient with an endoscopic perforation and encourage him and his colleagues to share more of their results with us.

Geoffrey M. Graeber, M.D., F.C.C.P., Director, Division of Surgery, Walter Reed Army Institute of Research, Washington, DC

Resistance of Expiratory Positive Pressure Valves

To the Editor:

I am writing to you with regard to an article which appeared in Chest 1986;90:215-17.

The article, entitled "Flow Resistance of Expiratory Positive Pressure Valve Systems", by Michael J. Banner and co-authors describes an evaluation of commercially available expiratory positive pressure valve systems used to provide continuous positive airway pressure (CPAP) and positive end-expiratory pressure (PEEP). This article included evaluations of both separate valve systems and integrated functions and ventilators such as the Servo Ventilator 900 C.

Normally, it has not been our company's policy to request rebuttals to articles published in clinical journals. In most cases we find that clarifications are generally addressed by the authors themselves or in work conducted by other investigators.

In this specific case, we have followed our standard policy: we contacted the authors to discuss test procedures and methods used in the study. Direct communication with the investigator is important so we have the opportunity to clarify questions and/or concerns related to the use of our product. During the last year and a half we have repeatedly attempted to try to communicate with the authors,
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 assumption 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. 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. Separation of the ventilator breathing circuit or isolation of individual components as described in the test procedures are not recommended by the manufacturers. 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

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<th>Flow rate (LPM)</th>
<th>Pressure drop (cm H₂O)</th>
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<td>60</td>
<td>7</td>
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<td>100</td>
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<td>120</td>
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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.

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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. 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, inflatable balloon or mushroom valve). Threshold resistors generate pressure (P) by exerting force (F) over a discrete surface area (SA). PaF/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 900 C 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

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