Compliance can only be used as an approximation of the actual value of Cdyn. As a rule, the effective compliance was three times smaller than Cdyn.

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To the Editor:

I appreciate the comments of van Veenen et al. Data concerning comparison of pulmonary compliance and effective compliance in the patient receiving mechanical ventilation are needed. Good correlation between these measurements in patients with low compliance documents the simpler estimate of effective compliance as a useful monitoring tool in the patient who is receiving mechanical ventilation and has low compliance. Effective pulmonary compliance is altered by the state of relaxation of the patient and by characteristics of the chest wall and should be used only as an approximation of pulmonary compliance. Serial determination of either measurement does reflect alteration in mechanics of the respiratory system. Thus, changes in compliance in the patient with high compliance should be useful even though absolute values correlate poorly.

It is sometimes difficult to keep an esophageal catheter in the patient with respiratory failure for long periods of time because of the need for nasogastric feeding and the concern about mechanical irritation of the esophagus. We have recently used central venous fluctuations with respiration as an estimate of pleural pressure in patients with a thermodilution Swan-Ganz catheter in place. The approximations of pleural pressure from the esophageal balloon and central venous line have correlated closely.

We have made preliminary observations of the correlation between pulmonary compliance and effective compliance before and after production of noncardiogenic and cardiogenic pulmonary edema,1 pneumothorax,2 and mucous plugging and atelectasis3 in experimental animals. In our studies, changes in effective compliance correlated well with changes in pulmonary compliance.

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REFERENCES


Bronchiolitis Obliterans
A New Form of Rheumatoid Lung?

To the Editor:

In their report entitled "Severe Airway Disease Due to Inhalation of Fumes from Cleansing Agents," Murphy and his colleagues1 rightly stated that the causative role of the chemical fumes is conjectural but can offer no other explanation for the severe disease of the airways. The patient's rheumatoid status is discussed in the light of those patterns of pulmonary disease currently recognized as associated with rheumatoid arthritis, notably interstitial fibrosis. This pattern Murphy et al. satisfactorily excluded, and it is implied that the rheumatoid arthritis is therefore coincidental; however, of the six patients with bronchiolitis obliterans whom we have encountered over the last six years, five had classic seropositive rheumatoid arthritis (American Rheumatism Association's criteria), while the sixth had circulating antinuclear antibodies. Such a strong association seems to be more than coincidental, and we have therefore suggested that rheumatoid patients may handle the agents that cause bronchiolitis (viruses and chemical fumes) particularly badly and are thus unduly prone to develop an obliterative disease of the airways.2 Bronchiolitis obliterans may therefore represent a previously unrecognized form of rheumatoid pulmonary disease. Detailed reports on our patients are in preparation.3

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REFERENCES


Heparin Sodium and Arterial Blood Gas Analysis

To the Editor:

Questions arise concerning the validity of arterial blood gas measurements when overdilution with a solution of heparin may have occurred. A frequently used reference states that "if too much sodium heparin is used, it will affect the pH to the acidic side."10(101) and

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therefore recommends that not more than 0.05 ml of a solution of heparin per milliliter of blood be used.\textsuperscript{1} This caution is based on the original work of Siggaard-Andersen,\textsuperscript{2} who demonstrated that concentrations of heparin of less than 1 mg/ml (approximately 100 units/ml) did not affect the pH, but that for each 1-mg/ml increase thereafter, the pH declined 0.003 units, and the arterial carbon dioxide tension (\(\text{PaCO}_2\)) rose 0.1 mm Hg. In a separate experiment, Siggaard-Andersen\textsuperscript{2} demonstrated that a 12 percent dilution of whole arterial blood with physiologic saline solution resulted in a rise in the pH of 0.003 units, with a decline in \(\text{PaCO}_2\) of 1 percent of the original value for each 1 percent of dilution; however, there appears to be no clear statement in the clinical literature as to whether adding large amounts of a solution of heparin to blood (which simultaneously increases the concentration of heparin and dilutes the blood) will alter the measured pH, the arterial oxygen pressure (\(\text{PaO}_2\)), and the \(\text{PaCO}_2\) to a degree that is clinically significant. The following study was conducted to answer this question.

**Materials and Methods**

Twenty-five samples of arterial blood (each 6 to 10 ml) were collected from 25 patients, using just enough of a solution of heparin sodium (1,000 United States Pharmacopeia units per milliliter) to fill the dead space of a 10-ml syringe and 20 gauge needle (approximately 0.2 ml). The samples were kept on ice during the entire analysis. All samples were analyzed on calibrated blood gas analyzers (Radiometer PHM 71 Mk2 Acid-Base and Radiometer BMS Mk3 Blood Micro System Analyzers).

After measurement of the initial values for pH, \(\text{PaCO}_2\), and \(\text{PaO}_2\), the samples were serially diluted using 0.5-ml increments of the solution of heparin sodium; and the pH, \(\text{PaCO}_2\), and \(\text{PaO}_2\) were remeasured at each increment of dilution. Several other specimens were diluted in one step to 50 percent. The changes in pH, \(\text{PaCO}_2\), and \(\text{PaO}_2\) were analyzed statistically using the \(t\)-test applied to the mean of the difference between matched pairs at the 95 percent confidence level.

**Results and Discussion**

The concentrations of heparin sodium ranged from 20 to 1,147 units/ml of blood, and the percent dilution ranged from 8.4 percent to 50 percent. One-step dilution and incremental dilution gave the same magnitude of change. The change in pH, \(\text{PaO}_2\), and \(\text{PaCO}_2\) with the addition of the solution of heparin sodium is expressed in Table 1 as a percent of the initial value (for simplicity and brevity).

It is not hard to imagine, under the varied circumstances in which arterial blood gas measurements are obtained, that an occasional specimen might suffer dilution by as much as 20 percent or more and might achieve concentrations of heparin sodium of 200 units or more per milliliter of blood (i.e., 0.5 ml of the solution of heparin sodium in 2 ml of arterial blood). Our data show that this would not result in either a clinically or statistically significant shift in the pH to the "acidotic" side, and this appears to hold for even more extreme dilutions. Such dilution does result in erroneous values for the \(\text{PaCO}_2\), which declines 1 percent for each 1 percent of dilution, as predicted by Siggaard-Andersen.\textsuperscript{2} The values for \(\text{PaO}_2\) rose but were not significantly altered in our samples, even with extreme dilution; however, it should be noted that the initial values for \(\text{PaO}_2\) (44 to 86 mm Hg) in all samples were considerably lower than those required for full saturation of hemoglobin. If inadvertent dilution of a sample for arterial blood gas analysis is suspected, the pH and \(\text{PaO}_2\) can be relied upon in making therapeutic decisions.

**Table 1—Changes in pH, \(\text{PaO}_2\), and \(\text{PaCO}_2\) of Arterial Blood with Addition of a Solution of Heparin Sodium**

<table>
<thead>
<tr>
<th>Percent Dilution with Solution of Heparin Sodium</th>
<th>Percent of Initial Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>(\text{PaO}_2)</td>
</tr>
<tr>
<td>0 percent</td>
<td>100</td>
</tr>
<tr>
<td>10 percent</td>
<td>100</td>
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<tr>
<td>20 percent</td>
<td>100</td>
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<td>30 percent</td>
<td>100</td>
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<tr>
<td>40 percent</td>
<td>100</td>
</tr>
<tr>
<td>50 percent</td>
<td>100</td>
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</tbody>
</table>

\(\text{PaCO}_2\) and \(\text{PaO}_2\) values are expressed as percentage of initial value. \(\text{PaCO}_2\) remained within normal limits for all dilutions. \(\text{PaO}_2\) remained within normal limits for all dilutions.

Reprint requests: Dr. Scheinorn, Pulmonary Service, Veterans Administration Hospital, Salt Lake City

**References**


**Pseudolymphoma of the Lung with Prolonged Follow-Up**

To the Editor:

Pseudolymphoma of the lung is an uncommon disease in which the natural history and the appropriate treatment are poorly defined.\textsuperscript{1,2} Our case demonstrates that this disease can have a benign clinical course for many years, even though progressive localized enlargement is observed radiologically. Also described is the response to therapy with corticosteroids.

**Case Report**

On a routine chest x-ray film in 1971, the patient, an asymptomatic 63-year-old woman, was found to have a well-circumscribed density in the right upper lobe, containing air bronchograms; also present on this x-ray film was a small nodule.