Serum-effusion Albumin Gradient in Separation of Transudative and Exudative Pleural Effusions

To the Editor:

We read with interest the article by Roth et al, which appeared in the September 1990 issue of Chest.

The serum-effusion albumin gradient of 1.2 g/dl is proposed as a diagnostic tool in differentiating exudate and transudate in patients with pleural effusions, especially following diuretic therapy. The same parameter, but at a level of 1.1 g/dl, has been found useful in the differential diagnosis of ascites in cirrhosis.

We prospectively studied 54 consecutive patients (36 men, 18 women, mean age 57 ± 11 years old) who were undergoing diagnostic or therapeutic thoracocentesis to compare the diagnosis made using the serum-effusion albumin gradient with that using the Light et al traditional criteria.

Using the Light et al criteria, 42 patients were defined as having exudates (16 malignancy, 13 tuberculosis, 9 parapneumonic, 1 systemic lupus erythematosis (SLE), 1 rheumatoid arthritis, 1 radiation-induced, 1 Christian-Weber syndrome), and 12 as transudates (1 cirrhotic ascites, 11 congestive heart failure).

The effusion protein and lactate dehydrogenase (LDH) levels, the effusion/serum protein and LDH ratios, and the serum-effusion albumin gradient of 1.2 g/dl in each group were compared using Student's unpaired t test and were all significantly different (Table 1).

Using albumin gradient cutoff value of 1.2 g/dl to indicate a transudate, 22 patients were classified as having transudates. Eleven of these patients had clinical congestive heart failure and one had cirrhotic ascites. However, ten patients (four parapneumonic, one lymphoma, one radiation-induced, two tuberculosis, one malignancy, one SLE) were misclassified as transudate. The mean albumin gradient in these misclassified patients was 1.84 ± 0.41 (range: 1.3-2.6 g/dl). In the same group, one patient with tuberculosis and one patient with parapneumonic pleural effusion also had chronic renal failure.

Diuretic treatment of patients with congestive heart failure caused significant elevation of the protein content; in some cases, a transudate might be converted into a pseudoexudate-high protein transudate. We performed thoracocentesis immediately on identification of a patient with congestive heart failure before any diuretic therapy was given to rule out the possibility of pseudoexudates. Therefore, we did not observe any patient with high protein transudate.

In the present study, the albumin gradient was 76 percent sensitive and 100 percent specific to indicate exudates. Light’s criteria were 100 percent sensitive and 100 percent specific at identifying exudates. The difference between the sensitivities is clearly not significant using the proportion test (p < 0.05); McNemar’s exact test showed a statistically significant difference between these two methods (p < 0.05).

In a group of 26 patients with malignant effusions both et al were able to identify only two patients with an albumin gradient in the transudative range, and proposed the use of this parameter, partially in cases of congestive heart failure.

We conclude that the serum-effusion albumin gradient is a reliable criterion for differentiating exudative from transudative effusion. We found this gradient, however, compared with Light’s criteria, has a tendency to overdiagnose a transudate, and we believe its use should be limited to patients suffering from heart failure.

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REFERENCES


To the Editor:

The results reported by Dr. Ceyhan differ from ours in two very important aspects. First, he specifically excluded patients with congestive heart failure who are on chronic diuretic therapy. These are the very patients where the albumin gradient appears to be helpful and where it appeared that the albumin gradient was more specific than the Light et al criteria (Chest 1990; 98:546-49).

Second, he reports a much lower sensitivity with 10 of 42 patients having exudative effusions misclassified as transudates using the albumin gradient. This is very concerning and calls into question the utility of the albumin gradient since we propose it as a method to confirm that a "pseudoexudate" by Light’s criteria is actually a transudate. By combining multiple tests, Light’s criteria provide a heightened sensitivity for exudates.

However, Dr. Ceyhan states that he used Light’s criteria to define exudates and transudates. If a test is used in the definition of disease, then it will make that test appear 100 percent sensitive and specific. Also, it would be important to review the clinical data from the misclassified patients to closely look for secondary transudative causes of pleural effusion such as coexistent congestive heart failure or renal failure with fluid overload. As in studies of the albumin gradient applied to ascites, our data suggest that when an exudative cause for pleural fluid is combined with a transudative cause, the albumin gradient reflects the pressure gradient and appears transudative.

Although Dr. Ceyhan’s data is relevant, we do not think it changes our suggestion that the albumin gradient can be helpful as an adjunct to the Light et al criteria for exudates.

Table 1 — Pleural Fluid Characteristics

<table>
<thead>
<tr>
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<th>Exudative*</th>
<th>Transudative</th>
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</thead>
<tbody>
<tr>
<td>Pl eff LDH level (U/ml)</td>
<td>606 ± 140</td>
<td>76 ± 20</td>
</tr>
<tr>
<td>Pl eff protein level (g/dl)</td>
<td>4 ± 1.2</td>
<td>1.9 ± 0.9</td>
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<tr>
<td>Pl eff/ser LDH ratio</td>
<td>4.8 ± 1.7</td>
<td>0.48 ± 0.4</td>
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<tr>
<td>Pl eff/ser protein ratio</td>
<td>0.65 ± 0.16</td>
<td>0.31 ± 0.13</td>
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<tr>
<td>Ser-pl eff albumin gradient</td>
<td>0.93 ± 0.62</td>
<td>1.75 ± 0.58</td>
</tr>
</tbody>
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X ± SD
*p < 0.05.
Oximeter Malfunction

To the Editor:

We wish to report a pattern of oximeter malfunction to your readers, as many have experienced similar problems. The University of New Mexico Hospital recently acquired the Marquette Tramscopel with Tran 200h (Marquette Electronics, Milwaukee), which uses the Ohmeda disposable EasyProbe (Ohmeda Monitoring Systems, Louisville, Colo) for oxygen saturation monitoring. We noticed that this new system often gave the alarm signal "Probe off patient." Approximately 150 additional probes were used on patients over a 2-week period because of the belief that these were malfunctioning, since they appeared to be correctly applied. Each probe costs $2.13, resulting in an excess expenditure of approximately $3,200.

Further investigation revealed that this false error was only occurring in south-facing rooms and was caused by failure to exclude extraneous incident sunlight. Using the Lutron LX-101 luxmeter (Cole-Palmer Instrument, Niles, Ill), we documented that sunlight falling on the probe with an intensity of more than 995 lux caused significant signal deterioration and that above 1,110 lux the error signal "Probe off patient" was generated. For incandescent light, the required intensity was 2,000 lux. We were unable to generate an error signal with fluorescent light because of its lower intensity (only 1,300 lux was achieved with all lights on in patient rooms). Shielding the sensor with aluminum foil abolished all false alarm signals.

It is fortunate that the Ohmeda oximeter system generates an alarm condition of "Probe off patient" as the addition of extraneous light is usually sensed as the wavelengths of both oxyhemoglobin and deoxyhemoglobin, resulting in a ratio of 1:1, which is interpreted as a saturation of 85 percent.1 This saturation will not vary with changes in actual patient oxygen saturation. The EasyProbe has a light-emitting diode intensity of 43 mW. Ohmeda has created the OxyTip sensor, which uses 121 mA and minimizes this problem. This new device includes a foil backing and completely excludes incandescent light. Sunlight is excluded until it exceeds 4,000 lux. The new OxyTip probe is now available at a lower cost than the EasyProbe and is therefore our preferred device.

We suggest that when unvarying saturations of 87 percent are recorded or the "Probe off patient" signal is generated, extraneous light should be measured and excluded before changing probes. This will increase patient safety and result in lower patient charges.

Howard Levy, M.D.