Observations on the Cytology of Tracheobronchial Secretions Collected by a New Technique*

DAVID V. PECORA, M.D., and M. WILSON TOLL, M.D.
Ray Brook, New York

Expectorated sputum and secretions aspirated through the bronchoscope frequently contain contaminants from the oral cavity.1 Because of this, it has not been possible often to accurately determine the cytology of the tracheobronchial tree in normal or diseased patients. Carabelli2 after studying secretions obtained by bronchoscopic aspiration reported that they normally contained ciliated columnar, goblet, undifferentiated bronchial, and squamous cells in addition to macrophages. He attributed blood elements to trauma, and did not consider them a part of the normal cytogram. Moreover, he believed that squamous cells probably represented elements which had been aspirated deep into the bronchial tree, presumably from the supraglottic region. For this reason little importance was attributed to their presence. In suppurative bronchopneumonitis he found leukocytes prominent and predominating. It has been our experience3 that under both normal and pathological conditions, in the absence of instrumentation, oral contents are rarely aspirated into the tracheobronchial tree.

Recently a procedure was developed, which permitted us to obtain secretions by transtracheal aspiration.4 This enabled us to study not only the bacteriology, but also the cytology of the specimens.

Prior to the procedure the patient is given a suitable dose of barbiturate for sedation. A small pillow is placed beneath the patient's shoulders and the neck is extended as he lies supine. The anterior neck is prepared with an antiseptic and draped with sterile towels. A small cutaneous wheal of 0.5 per cent procaine is then made over the membranous trachea about 1 centimeter below the lower border of the cricoid cartilage in the midline. Following this a 15 gauge needle is inserted through the wheal into the trachea the point being directed caudad. A 6" length of sterile polyethylene tube (internal diameter 0.034 inch and outside diameter 0.05 inch) is inserted into the trachea through the needle, after which the latter is withdrawn. Following this about 1 to 3 cc. of 0.9 per cent saline solution is injected into the tube with the aid of a syringe fitted with a 20 gauge needle. The patient is encouraged to cough as suction is applied to the tube by the same syringe. If an adequate specimen of sputum is obtained mucous will be noted in the syringe. If bleeding should occur through the puncture site it can easily be controlled by pressure with a sterile gauze pledget.

Immediately after the secretions are aspirated by tracheal puncture a large drop is placed upon a glass microscope slide previously coated with a thin layer of Mayer's albumin. A smear is made by apposing the surface to that of another slide and pulling the slides apart in a plane parallel with their surfaces. The slides are immediately fixed in ether and alcohol according to the Papanicolaou5 method (No. 268). One slide

*From the Ray Brook State Tuberculosis Hospital.
is then stained in accordance with the Papanicolaou technique; the other is allowed to dry, after which it is stained by standard Gram's method. The specimens are carefully examined under the microscope to identify bacteria and cell types, and to estimate relative numbers of the various types of cells. The tracheobronchial secretions are also routinely cultured for pyogenic organisms as previously described.

Results

In Table 1 cases are listed according to diagnosis. There was no "normal" subject. All had pulmonary infiltration by roentgenogram. All had polymorphonuclear leukocytes in the tracheobronchial aspirates. However, the proportion of patients with "many" polymorphonuclear leukocytes is higher in the group which had carcinoma or evidence of active pulmonary infection (including infectious tuberculosis, blastomycosis, pulmonary abscess, and aspergillosis) than in the group which did not (including noninfectious pulmonary tuberculosis, undiagnosed pulmonary disease or subphrenic abscess).

The role of inhaled irritants in the production of purulent sputum may be surmised from the fact that 52 per cent of the patients smoked over 20 cigarettes a day and only 17 per cent did not smoke. Only 5 per cent gave a history of exposure to dusts which might have been responsible for pneumoconiosis. Twenty seven per cent had recently lived in large cities, where air pollution might have provided a source of irritation to the lower respiratory tract. It is interesting to note that of the 82 patients included in this study there were only seven who gave a history of smoking less than 20 cigarettes a day and offered no evidence of active pulmonary suppuration. It is obviously difficult to locate subjects who are not exposed to some type of bronchial irritant, either chemical or bacterial.

\[\text{TABLE 1 — CYTOLOGY OF TRACHEOBRONCHIAL SECRETIONS ACCORDING TO DIAGNOSIS}\

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Infectious Tuberculosis</td>
<td>45</td>
<td>38</td>
<td>7</td>
<td>22</td>
<td>23</td>
<td>26</td>
<td>42</td>
<td>28</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noninfectious Tuberculosis</td>
<td>11</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>7</td>
<td>5</td>
<td>11</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blastomycosis</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspergillosis with Silicosis</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulmonary Abscess</td>
<td>2</td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subphrenic Abscess</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undiagnosed Pulmonary Disease</td>
<td>14</td>
<td>8</td>
<td>6</td>
<td>5</td>
<td>8</td>
<td>1</td>
<td>9</td>
<td>13</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bronchogenic Carcinoma</td>
<td>7</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>6</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Polys. = Polymorphonuclear leukocytes; Monos. = Monocytes and lymphocytes; Squam. = Squamous epithelial cells; Column. = Columnar epithelial cells; Macroph. = Macrophages; Malig. = Malignant cells; Micro. = Microscopic. M = Many; F = Few; O = None.

*One of these patients also had noninfectious tuberculosis.
In translating microscopic findings to macroscopic terminology it should be noted that although 20 of our patients yielded expectorations which were described by the examiner as mucoid, every patient had polymorphonuclear leukocytes in the tracheal aspirates.

Reference to Table 1 reveals that it was possible to diagnose or suspect carcinoma in a single specimen in a considerable proportion of the patients who had the disease. The high incidence of squamous cells, which were of the "superficial" type is interesting, since these do not normally originate in the lower respiratory tract unless metaplasia exists. It appears unlikely that many of these cells could have originated above the vocal cords since accumulated bacteriological data indicate that contamination of lower respiratory tract with pharyngeal contents is rare. Since metaplasia of the bronchial mucosa may occur as the result of irritation, it is noteworthy that 51 per cent of the patients in this series were found to have reddened bronchial mucosa at bronchoscopy. The consistent presence of columnar bronchial epithelium is considered an indication of the adequacy of the specimen.

Discussion

From the evidence presented in this study it appears likely that polymorphonuclear leukocytes are to be found in the respiratory tract under a variety of conditions. Where expectorations are purulent leukocytes tend to be more abundant. However, they are frequently present when the sputum is grossly nonpurulent. In the presence of infection, carcinoma, or following inhalation of irritants this is understandable. However, there is some evidence that leukocytes frequently occur in the secretions of normal individuals. Such conclusions are based upon the knowledge that the lungs normally tend to filter white cells from the circulation. The difference between the normal and abnormal with respect to the number of leukocytes in the tracheobronchial secretions may be only relative.

With the technique employed in this study it appears that contaminants from the supraglottic region are rare. Since squamous epithelial cells are not normally found below the vocal cords, it is probable that their presence, in tracheal aspirates obtained by the method described, may indicate the presence of metaplasia of the bronchial epithelium.

SUMMARY

Tracheal secretions were collected from 82 patients with various pulmonary diseases by a method which permitted little contamination. Secretions from those with both infectious and noninfectious tuberculosis, blastomycosis, aspergillosis and silicosis, suphrenic abscess, pulmonary abscess, carcinoma, and various undiagnosed pulmonary conditions contained polymorphonuclear leukocytes. Grossly nonpurulent sputum always contained leukocytes, although usually not as many as purulent sputum. Squamous cells were found in a considerable number of samples, and under the conditions of this study are considered evidence of metaplasia of the bronchial mucosa. Evidence of bronchial irritation was found in 51 per cent of the patients by bronchoscopy. Only three in this series yielded no evidence of infection, carcinoma or inhalation of irritants. It appears likely that leukocytes may be found in a large proportion of tracheobronchial secretions from normal individuals.

RESUMEN

Se han colectado las secreciones traqueales de 82 enfermos con varios padecimientos pulmonares por un método que permite poca contaminación.

Fueron secreciones provinientes de tuberculosis infectante y no infectante, blastomicosis, aspergilosis y silicosis, absceso subfrénico, absceso pulmonar, carcinoma y varios padecimientos no diagnosticados.

Los esputos aparentemente no purulentos siempre contenían leucocitos, aunque habitualmente no tantos como los purulentos.

Se encontraron células escamosas en un número considerable de muestras y bajo las condiciones de este estudio, se consideran como evidencia de metaplasia de la mucoa bronquial.

Prueba de irritación bronquial se encontró en 51 por ciento de los enfermos, por broncoscopia. Sólo tres de esta serie no dieron evidencia de infección, carcinoma o inhalación de irritantes. Parece posible que los leucocitos pueden encontrarse en gran proporción de secreciones de individuos normales.
RESUMÉ

Des sécrétions trachéales furent recueillies sur 82 malades atteints de différentes affections pulmonaires, par une méthode qui permet peu de contamination. Les sécrétions de ceux atteints de tuberculose aussi bien bacillifère que non bacillifère, de blastomykose, d’aspergillose et de silicose, d’abcès sous-phrénique, d’abcès pulmonaire, de cancer et de différents états pulmonaires de diagnostic indéterminé contenaient des leucocytes polymorpho-nucléaires. Une expectoration macroscopiquement non purulente contenait toujours des leucocytes, bien qu’habituellement en quantité moindre que l’expectoration purulente. Des cellules épidermides furent trouvées dans un nombre considérable d’échantillons, et dans les conditions de cette étude, sont considérées comme la preuve métaplasie de la muqueuse bronchique. La preuve d’une irritation bronchique fut trouvée dans 61% des malades par la broncoscopie. Trois malades seulement sur ce groupe ne fournirent aucune preuve d’infection, de cancer ou d’inhalation de substances irritantes. Il paraît vraisemblable que des leucocytes peuvent être trouvés dans une grande proportion des sécrétions trachéobronchiques chez les individus normaux.

ZUSAMMENFASSUNG


REFERENCES


BRONCHOESOPHAGEAL FISTULA IN A CASE OF TUBERCULOSIS CURED BY CHEMOTHERAPY

A case is described in which bronchoesophageal fistula arose from a tuberculous lymph node in the mediastinum. Gastrastomy was performed, and the patient was treated with streptomycin and INH; this resulted in healing of the fistula. One year later, the patient was examined. Her general condition was good and there was no evidence of the fistula. The result of treatment should be considered permanent.


EFFECT OF HISTAMINE AND SEROTONIN ON BRONCHIAL MUSCLES OF GUINEA PIGS

A comparative evaluation is made on the bronchospastic action of serotonin and histamine on isolated trachea and with aerosol treatment of guinea pigs. Equal doses of the two amines used, exerted analogous effects as to intensity and duration in both experimental and natural conditions. An additive effect is noted when the two substances are used together. The combined effects of the two amines most probably are responsible for the anaphylactic bronchospastic shock in guinea pigs.