Bacteriologic Diagnosis of Tuberculosis
in Mentally Ill Patients*

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It is hard to handle and to treat a mentally ill tuberculosis patient. His tuberculosis governs the field of treatment often to the detriment of his mental condition.

The impossibility to impose the rules of elementary hygiene on the mentally ill is chiefly responsible for the high incidence of tuberculosis among the patients of mental institutions. In 1950, the 231 institutions for mentally ill in the United States, with the total population of 511,064, reported 13,911 cases of active tuberculosis, that is 2700 per 100,000 inmates, compared with the 80 cases in the general population of this country. (Bettag, 1952.)

To prevent the spread of this disease, the early diagnosis of open tuberculosis is of utmost importance in mental institutions. Obtaining the necessary material for the diagnosis from a mentally ill patient is connected with great difficulties. Due to their aggressive behavior there are patients at Anoka State Hospital from which such material can be obtained only rarely. It is almost impossible to collect the most important material for tuberculosis diagnosis, sputum, from a mentally ill person. According to Burns, 1945, in the institutions for the mentally ill of Minnesota it was extremely difficult to get a specimen of sputum from more than 2 or 3 per cent of the patients. Even though cooperative, the mentally ill patient rarely understands the difference between sputum and saliva. Consequently, the most suitable material available, would be a gastric specimen. Unfortunately, gastric lavage is a long and disagreeable procedure among mentally ill people. This is particularly true if the first lavage is not easily performed. These circumstances motivated our attempts to find an easier way to collect pathologic material for tuberculosis diagnosis.

The laryngeal swab for collecting tuberculosis material is recognized as an easier, more rapid and less time consuming procedure for collecting tuberculosis material than gastric lavage. We investigated the usefulness of this method in mentally ill patients.

Material

From the 422 tuberculous mentally ill at Anoka State Hospital we selected 100 male and 100 female patients who, according to their most recent lavages, were positive for tubercle bacilli. These patients were positive by gastric lavage:

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Thus, among 200 investigated, 114 or 57 ± 3.5 per cent had shown positive gastric lavage results for tubercle bacilli in the last year. The rest of them, that is all but six, had been found positive in the course of the last four years. The total number of their gastric lavages examined before we started our work with these 200 patients was 2,681, or an average of 13.4 per patient. In 1,151 instances, or 42.9 ± 0.95 per cent, the gastric lavages had been positive, in 1,530 or 57.1 ± 0.95 per cent had been negative for tubercle bacilli. All 200 were subjected to one gastric lavage, and one laryngeal swab was taken from each patient.

Method

The cultivation of gastric specimens, collected in sterile bottles containing sodium phosphate as preservative, was carried out at the State Health Laboratory in Minneapolis, where the material from Anoka was delivered on the day of collection. The cultivation of swab material was performed in the laboratory at Anoka State Hospital.

Our swab consists of a piece of wire eight inches long, slightly bent, corresponding to the curve of the tongue and carrying a ball of gauze. The swab was sterilized in autoclave in a centrifuge tube. The operator passes the swab into the larynx until coughing is provoked.

The quantity of tuberculous material obtained by the swab is small in comparison to the amount obtained by gastric washing. In some cases the material on the swab may contain only a small number of bacilli. Because of this, the concentrating method of bacilli, described by one of us (Darzins, 1951) was applied to the swab material. This technique has been recognized as far superior to sulfuric acid procedure for culturing of a small number of bacilli (Weidmann, 1952; Mitscherlich, Reuss, Gürtürk, 1952).

The swab extracted from the larynx was returned to the centrifuge tube and covered with 10 ml. of purifier (mixture of 1 per cent NaOH and 1 per cent Na₂PO₄ ·12 H₂O), thoroughly washed and drained on the walls of the tube; the second washing of the swabs was done in 2 ml. of saline, and both liquids were united. After resting for 1 hour at room t°, with occasional shaking of the tubes, 1 ml. of 1 per cent sterile solution of calcium chloride was added to the tubes and mixed with the purifier. Abundant flocculation of gelatinous calcium phosphate appeared:

\[ 2 \text{Na}_2\text{PO}_4 + 3\text{CaCl}_2 \rightarrow \text{Ca}_3 (\text{PO}_4)_2 + 6 \text{NaCl} \]

After the tubes had been centrifuged for five minutes, the clear supernatant liquid was discarded. To the precipitate on the bottom, 0.3 ml. of solvent (mixture of citric acid 3 g., ammonium citrate 2.5 g., sodium citrate 2 g., distilled water 100 ml., sterilized in an autoclave) was added.
The citrates dissolve unsoluble calcium phosphate and neutralize the alkalies so that the concentrated material can be inoculated by means of an ordinary pipette in the media. Two tubes of solid egg-potato medium and one tube of our liquid medium (described earlier) were used for each concentrated swab material. The solid medium was incubated at 37°C. for six weeks, the liquid medium was incubated for two weeks; thereupon the supernatant clear liquid was taken off the deposit with a pipette, approximately 0.5 ml. of the deposit was spread over the slide, dried and stained with Ziehl-Neelsen carbolfuchsin, decolorized with acid alcohol and counterstained with half saturated picric acid dissolved in water.

Results

The gastric lavages, as reported by the State Health Laboratory, gave positive results for tubercle bacilli in 61 patients, or 30.5 ± 3.3 per cent of the investigated. Swabs from the same patients revealed 49 or 24.5 ± 3.0 per cent positive results. Both gastric lavage and swabs revealed 76, or 38 ± 3.3 per cent positive cases. The liquid medium was positive in 33, that is 16.5 ± 2.6 per cent cases; in 3 instances only did the liquid medium reveal tubercle bacilli.

Efficiency of gastric lavage and swab methods in detecting tubercle bacilli in 200 mentally ill patients:

<table>
<thead>
<tr>
<th>Procedure and Medium</th>
<th>Positive for Tubercle Bacilli</th>
<th>Per Cent Positive Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastric lavage, solid medium</td>
<td>61</td>
<td>30.5 ± 3.3</td>
</tr>
<tr>
<td>Swabs, solid and liquid media</td>
<td>49</td>
<td>24.5 ± 3.0</td>
</tr>
<tr>
<td>Gastric lavage and swabs</td>
<td>76</td>
<td>38.0 ± 3.4</td>
</tr>
<tr>
<td>Swabs, solid medium</td>
<td>46</td>
<td>23.0 ± 2.3</td>
</tr>
<tr>
<td>Swabs, liquid medium</td>
<td>35</td>
<td>16.5 ± 2.6</td>
</tr>
<tr>
<td>Swabs, positive in liquid medium only</td>
<td>3</td>
<td>1.5 ± 0.9</td>
</tr>
</tbody>
</table>

Addition of one laryngeal swab to one gastric lavage increased the total positive result by 7.5 per cent. Gastric lavage was positive in 45 per cent male and 31 per cent female patients. The “esthetic factor,” greater swallowing of sputum on the part of female than male patients (Robinson and Dunn, 1943) was lost in mentally ill patients.

The liquid medium gave early positive results and information concerning the pathogenic properties of the bacilli. The colonies grown in the liquid medium could be detected by a microscope lens of low power and showed the characteristic growth pattern of pathogenic mammalian tubercle bacilli, namely the cord formation.

Out of inoculated tubes, eight with solid medium and four with liquid medium were lost because of contamination.

Discussion

The gastric specimens produced 6 per cent more positive cultures than concentrated material from swabs. It is questionable whether this differ-
ence arises from the greater efficiency of the gastric method as compared to the swab procedure. Statistically, this difference is not significant.

SUMMARY

The causes for the high incidence of tuberculosis in mentally ill patients were indicated. The absence of sputum and the difficulty of obtaining gastric specimens from such patients makes the diagnosis of tuberculosis difficult. The efficiency of the concentrated laryngeal swab technique for cultivation of a small number of tubercle bacilli was compared with the efficiency of gastric lavage in 200 mentally ill tuberculous patients. Solid and liquid media were used for the cultivation of laryngeal swab material. One gastric lavage produced 30.5 per cent, one laryngeal swab gave 24.5 per cent positive cultures of tubercle bacilli. One laryngeal swab added 7.5 per cent positive cases to those detected by gastric lavage. The liquid medium produced 16.5 per cent early cultures and revealed the pathogenicity factor, the cord formation, of the bacilli. The “esthetic factor,” greater swallowing of sputum in females than in males, is lost in mentally ill patients.

RESUMEN

Se indicaron las causas de la elevada frecuencia de la tuberculosis entre los enfermos mentales.

La ausencia de esputos y la dificultad ad para obtener lavados gástricos hace el diagnóstico de tuberculosis, más difícil. Se comparó la eficiencia del método de los frotis de laringe por cultivo de pequeño número de gérmenes con el lavado gástrico, en 200 enfermos mentales. Para los cultivos de los productos laringeos se usaron medios sólidos y líquidos. Con un lavado gástrico se obtuvieron 30.5 por ciento. Con un frotis laringeo se obtuvieron 24.5 por ciento de cultivos positivos.

Un frotis laringeo agregó 8.5 por ciento a los obtenidos por lavabo gástrico. El medio líquido dió 16.5 de cultivos positivos y reveló el factor de patogenicidad del bacilo, la formación de cuer das del mismo.

El “factor estético,” consistente en que es mayor el número de mujeres que degluten sus esputos que los hombres, no existe entre los enfermos mentales.

RESUME

Les auteurs indiquent les causes du taux élevé de tuberculeux parmi les malades mentaux. L’absence d’expectoration et la difficulté d’obtenir des examens gastriques chez de tels malades rend le diagnostic difficile. La valeur de la culture par la technique de l’écouvillonnage laryngé est comparée à la valeur du tubage gastrique chez 200 malades mentaux tuberculeux paucibacillaires. Des milieux solides et liquides furent utilisés pour la culture par écouvillonnage laryngé. Par tubage gastrique, on obtint 30,5 % de cultures positives, l’écouvillonnage en donna 24,5 %. Le milieu liquide donna 16,5 % de cultures rapides et permit de mettre en évidence l’élément déterminant du caractère pathogène du bacille: sa disposition en torsades.
Le facteur "esthétique," incitant les femmes à cracher moins que les hommes, ne se retrouve pas chez les malades mentaux.

ZUSAMMENFASSUNG


BIBLIOGRAPHY

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