Basal Metabolism in Pulmonary Tuberculosis

Patients Under Collapse Therapy*

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On the basis of 567 determinations of the basal metabolic rate performed on 394 patients with pulmonary tuberculosis it was found in a previous publication¹ that there was a tendency to a low basal metabolic rate in these patients. Furthermore it was noted that in tuberculous patients the basal metabolic rate usually showed a tendency to decrease when they were on bed rest and under collapse therapy.

Numerous studies of the basal metabolic rate done by us since then have given similar results. Among the patients in whom these examinations were done, were many who had undergone various forms of collapse procedures.

Epstein and Pine² did determinations of the basal metabolic rate in patients with unilateral pneumothorax, with bilateral pneumothorax and with unilateral thoracoplasty and found a lowered rate in a good percentage of this group.

Topper and Rubin³ also found that in children there was a decrease of the basal metabolic rate following pneumothorax induction.

Since these basal metabolic rate studies were done in a relatively small number of patients and since they were done only in some forms of collapse therapy we thought it would be of interest to summarize the results we have obtained in a large number of tuberculous patients under various forms of collapse therapy.

Material and Method

The method was the same as outlined in a previous paper.¹ The age of the patients ranged between 16 and 60 years. Most of them had far advanced pulmonary tuberculosis, in a few only the disease was moderately advanced. All were afebrile at the time of their examination.

In the 11 years between 1939 and 1950, 185 determinations of

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†Sponsored by Veterans Administration and published with approval of the Chief Medical Director. The statements and conclusions published by the authors are a result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.
the basal metabolic rate were done on 145 patients with pulmonary tuberculosis who were under some form of collapse therapy. The examinations were done when the collapse was well established: In patients with pneumoperitoneum several weeks after induction of the pneumoperitoneum, in patients with pneumothorax, thoracoplasty or phrenic nerve crush, several months after the collapse had been achieved. When more than one examination was done on the same patient the average of the findings was taken.

Results

1) Pneumothorax: There were 55 patients with artificial pneumothorax (Figure 1). Twenty-seven (49.2 per cent) had a normal basal metabolic rate (between –10 per cent and +10 per cent). A diminished rate (< –10 per cent) was found in 25 patients (45.4 per cent). It was found increased (> +10 per cent) in three patients (5.4 per cent).

Further analysis of these figures reveals that a basal metabolic rate between –11 per cent and –20 per cent was found in 23 patients (41.8 per cent), and between –20 per cent and –30 per cent in two (3.6 per cent).

In the patients with pneumothorax the basal metabolic rate ranged between –24 per cent and +17 per cent. The average was –7 per cent, with a standard deviation of 9.2.

There were seven with bilateral pneumothorax. The average rate in these was –7 per cent with a standard deviation of 8.8.

2) Pneumoperitoneum: There were 17 patients with pneumoperitoneum (Figure 2). Thirteen (76.6 per cent) had a normal basal metabolic rate (between –10 per cent and +10 per cent).

![Figure 1: Distribution of basal metabolic rates in 55 patients with pneumothorax.](image1)

![Figure 2: Distribution of basal metabolic rates in 17 patients with pneumoperitoneum.](image2)
Four (23.4 per cent) had a diminished rate (< −10 per cent). Of these, three had rates between −11 per cent and −20 per cent, and one, between −21 per cent and −30 per cent. In none was an increased rate found.

In the pneumoperitoneum group the basal metabolic rate ranged between −21 per cent and +10 per cent. The average was −6 per cent, with a standard deviation of 7.7.

3) Thoracoplasty: There were 65 patients who had undergone thoracoplasties of various extent (4 to 8 ribs) (Figure 3). Of these, 39 (60 per cent) had a normal basal metabolic rate (between −10 per cent and +10 per cent). Twenty-one (32.3 per cent) had a diminished rate (< −10 per cent). An increased rate (> −10 per cent) was found in five (7.7 per cent).

A further break-down of these observations shows that 20 (30.8 per cent) had a basal metabolic rate between −11 per cent and −20 per cent, and one patient (1.5 per cent), between −21 and −30 per cent. Four (6.2 per cent) had a rate between +11 per cent and +20 per cent, one (1.5 per cent), between +21 per cent and +30 per cent.

In the patients with thoracoplasty the basal metabolic rate ranged between −23 per cent and +23 per cent. The average was −5 per cent, with a standard deviation of 10.1.

In addition, there were three in whom paraffin plombage had been done. Their rate ranged between −16 per cent and +10 per cent. The average was −4 per cent.

4) Phrenic crush: There were only five patients in whom a phrenic crush had been done. One of them (20 per cent) had a
### TABLE I: BASAL METABOLIC RATE IN PATIENTS UNDER COLLAPSE THERAPY

<table>
<thead>
<tr>
<th>Form of Collapse Therapy</th>
<th>No. of Patients</th>
<th>Range of Basal Metabolic Rate</th>
<th>Mean Basal Metabolic Rate</th>
<th>—— NORMAL ——</th>
<th>DECREASED</th>
<th>INCREASED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Per cent</td>
<td>Per cent</td>
<td>(-10 to +10%)</td>
<td>(&lt; -10%)</td>
<td>(&gt; +10%)</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>55</td>
<td>(-24, +17)</td>
<td>-7</td>
<td>27 49.2</td>
<td>25 45.4</td>
<td>3 5.4</td>
</tr>
<tr>
<td>Pneumoperitoneum</td>
<td>17</td>
<td>(-21, +10)</td>
<td>-6</td>
<td>13 78.6</td>
<td>4 23.4</td>
<td>0 0</td>
</tr>
<tr>
<td>Thoracoplasty</td>
<td>65</td>
<td>(-23, +23)</td>
<td>-5</td>
<td>39 60.0</td>
<td>21 32.3</td>
<td>5 7.7</td>
</tr>
<tr>
<td>Paraffin Plombage</td>
<td>3</td>
<td>(-16, +10)</td>
<td>-4</td>
<td>2 66.7</td>
<td>1 33.3</td>
<td>0 0</td>
</tr>
<tr>
<td>Phrenic nerve crush</td>
<td>5</td>
<td>(-22, -7)</td>
<td>-14</td>
<td>1 20.0</td>
<td>4 80.0</td>
<td>0 0</td>
</tr>
<tr>
<td>All patients</td>
<td>145</td>
<td>(-24, +23)</td>
<td>-6</td>
<td>82 56.6</td>
<td>55 37.9</td>
<td>8 5.5</td>
</tr>
</tbody>
</table>
normal basal metabolic rate. Four (80 per cent) had a diminished rate (< -10 per cent). Of these, three had rates between -11 per cent and -20 per cent, and one, between -21 per cent and -30 per cent. In no patient was an increased rate found.

In the patients with phrenic crush the basal metabolic rate ranged between -22 per cent and -7 per cent. The average was -14 per cent, with a standard deviation of 5.7.

5) All forms of collapse therapy: Altogether, there were 145 patients with pneumothorax, pneumoperitoneum, thoracoplasty, paraffin plombage or phrenic nerve crush in whom studies of the basal metabolic rate were done (Figure 4). Eighty-two (56.6 per cent) had a normal rate. A diminished rate was found in 55 (37.9 per cent). It was found increased in eight (5.5 per cent).

Among the patients with a decreased basal metabolic rate there were 50 (34.4 per cent) in whom it ranged between -11 per cent and -20 per cent and five (3.5 per cent), between -21 and -30 per cent. An increased rate between +11 and +20 per cent was seen in seven (4.8 per cent), between +21 and +30 per cent in one (0.7 per cent).

In all the patients with some form of collapse procedure the basal metabolic rate ranged between -24 and +23 per cent. The average was -6 per cent, with a standard deviation of 9.4.

Discussion

The findings are summarized in Table I. The results in the various groups are similar. No significant difference of the basal metabolic rate is found between patients with pneumothorax and thoracoplasty, which are the two largest groups.

In a previous study1 it was found that 64.9 per cent of 567 examinations in patients with pulmonary tuberculosis gave a rate within normal limits. A diminished rate was found in 21.0 per cent, an increased rate in 14.1 per cent. This tendency to a slightly subnormal basal metabolic rate is even more pronounced in patients with some form of collapse therapy: 37.9 per cent of the patients had a subnormal rate and only 5.5 per cent an increased rate. These findings agree with those of other authors.2,3

SUMMARY

Basal metabolism studies were done in 145 patients under various forms of collapse therapy for pulmonary tuberculosis. A normal rate (between -10 per cent and +10 per cent) was found in 82 patients (56.6 per cent). The rate was subnormal in 55 patients (37.9 per cent). It was above normal in 8 patients (5.5 per cent).

Of 55 patients with artificial pneumothorax, the rate was normal
in 27 (49.2 per cent). It was diminished in 25 (45.4 per cent). It was increased in three (5.4 per cent).

Of 17 patients with pneumoperitoneum, the rate was normal in 13 (76.6 per cent). It was diminished in 4 (23.4 per cent).

Of 65 patients with thoracoplasty, the rate was normal in 39 (60.0 per cent). It was diminished in 21 (32.3 per cent). It was increased in 5 (7.7 per cent).

Of five patients with phrenic nerve crush, the basal metabolism was normal in one and diminished in four.

Patients with pulmonary tuberculosis under collapse therapy show a more pronounced tendency to a subnormal basal metabolic rate than those without collapse therapy.

RESUMEN

Se hicieron estudios del metabolismo basal en 145 enfermos de tuberculosis, bajo diversas formas de colapso.

Se encontró un metabolismo normal entre 10 por ciento y 110 por ciento, en 82 enfermos (56.6 por ciento).

En 55 enfermos (37.9 por ciento) el M.B. fue subnormal, y en 5.5 por ciento el M.B. fue arriba de lo normal.

De 55 enfermos con neuromotorax artificial, el M.B. fue normal en 27 (49.2 por ciento), disminuido en 25 (45.4 por ciento) y aumentado en 3 (5.4 por ciento).

De 17 enfermos con neuromotorax, el M.B. fue normal en 13 (76.6 por ciento), disminuido en 4 (23.4 por ciento).

RESUME

Le métabolisme basal à été étudié chez 145 malades traités par différentes variétés de colles: 5 malades (56.6%) avaient un métabolisme normal (entre –10 et +10 pour cent). Les résultats furent subnormaux chez 55 malades (37.9%) et chez 8 malades (5.5%) au-dessous de la normale.

Parmi 55 malades traités par pneumothorax, les chiffres furent normaux chez 27 d'entre eux (49.2%), diminués chez 25 malades (45.4%), augmentés chez trois malades (5.4%).

Parmi 17 malades traités par pneumopéritoine, le métabolisme était normal chez 13 d'entre eux (76.6%) et diminué chez les quatre autres malades (23.4%).

REFERENCES