Intermittent Positive Pressure Breathing

An Adjunct in the Rehabilitation of Thoracic Surgery Patients*

Marilyn J. Anderson, Capt., WMSC, B.A. and
Elmore M. Aronstam, Lt. Col., MC,**

Phoenixville, Pennsylvania

In the past decade, important consideration has been given to the rehabilitation of post-operative thoracic surgery patients. Particularly in those institutions where large volumes of thoracic surgery have been done, the need for early restoration of shoulder function and chest motion has become obvious.

As early as 1934, Miss Winifred Linton at the Brompton Hospital1 in London, instituted, under Mr. J. E. H. Roberts, a pioneer rehabilitation program in the field of non-tuberculous chest surgery. In 1938, Mr. Tudor Edwards initiated a program of controlled breathing and shoulder exercises for post-thoracoplasty patients, with special emphasis directed toward posture correction. It was largely through his interest that this type of treatment was brought to the attention of American physicians on duty in England during World War II. Since that time, similar rehabilitation programs have been adopted in this country, particularly in Army2, 3, 4, 5 and Veterans’ Administration6, 7, 8 chest centers.

At Valley Forge Army Hospital, an extensive program of resectional surgery has been carried out in the past few years for tuberculous and non-tuberculous pulmonary problems. Each patient is seen by the Physical Medicine Service prior to surgery and is instructed in the exercises that will be expected of him post-operatively. These include localized pressure expansion and diaphragmatic breathing, a variety of the usual shoulder girdle motions, and postural correction. After surgery, beginning with the first post-operative day, active treatment is given until a satisfactory result is obtained, usually in two to three weeks.

One of the most perplexing problems in this treatment has been the fact that underwater seal drainage tubes and the operative incision cause discomfort and spasm to such a degree that the patient is often reluctant to use the operated side of the chest. We have been intrigued by the possibilities of the newly developed intermittent positive pressure breathing (IPPB) machines which cycle with the patient’s breathing and which deliver any amount of inspiratory pressure desirable up to 40 centimeters of water. We have felt that this instrument might be of value in overcoming the

*From the Thoracic Surgical Service and Physical Medicine Service, Valley Forge Army Hospital.
**Chief, Thoracic Surgery, Valley Forge Army Hospital.

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mental barrier to ventilation induced by post-operative pain. To this end, we have set up the following preliminary study.

Thirty routine patients undergoing resectional pulmonary surgery were employed in the study. They were operated upon for the following conditions:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary Tuberculosis</td>
<td>27</td>
</tr>
<tr>
<td>Bronchogenic Cyst</td>
<td>1</td>
</tr>
<tr>
<td>Hamartoma</td>
<td>1</td>
</tr>
<tr>
<td>Blastomycosis</td>
<td>1</td>
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</tbody>
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The operations performed were as follows:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lobectomy</td>
<td>1</td>
</tr>
<tr>
<td>Segmental resection</td>
<td>14</td>
</tr>
<tr>
<td>Segmental and wedge resection</td>
<td>12</td>
</tr>
<tr>
<td>Wedge resection</td>
<td>3</td>
</tr>
</tbody>
</table>

The average age was 31 years with extremes of 19 and 49 years. There were seven females and 23 males. There was no severely debilitated individual in the group and no serious or major post-operative complications were encountered.

![Figure 1: Dotted line indicates curve of patients receiving IPPB and exercise. Unbroken line indicates curve of patients receiving exercise alone.](http://journal.publications.chestnet.org/pdfaccess.ashx?url=/data/journals/chest/21281/)
The first 15 patients were treated with shoulder exercises and postural correction once a day and with pressure-expansion breathing exercises five minutes each treatment, four times a day, for the first two post-operative weeks. The second group received the same exercise regime, but in addition were given IPPB* at 5 to 20 centimeters of water concomitantly with pressure-expansion breathing, five minutes each treatment, four times a day, for the same post-operative period. While 20 minutes is the generally accepted length of IPPB treatment, is was felt that in view of the tiring effect of the respiratory effort and the post-operative status, a shorter period would be more suitable. After the first two weeks, breathing, shoulder and postural exercises were performed by all patients on their own, twice daily.

On the day before surgery, daily from the third to the 14th post-operative day, and again on the 21st and 28th days, total vital capacities were recorded on a Collins Timed Vitalometer.

Results

Taking the pre-operative value as the control, or 100 per cent, the patient’s daily post-operative vital capacity was computed as a percentage of the control. In each group of patients, the percentages of each post-operative day were totalled, divided by the number of patients in the group, and charted in figure 1. This graph shows a progressive, more rapid approach to the pre-operative value for the group of patients treated with IPPB in addition to exercise.

Discussion

This has been a fairly uniform group of young patients undergoing similar types of operations without serious operative or post-operative complications. Graphic results indicate firmly that patients receiving IPPB with exercises made a more rapid recovery of vital capacity than those with exercise alone. Observation from patient to patient leaves one with the impression that actual chest motion is recovered much more quickly in those receiving intermittent positive pressure breathing. To be sure, variation from patient to patient as far as his attitude toward surgery, his response to pain, and his medication can cloud the picture; however, we feel that the graphic results of observed vital capacities, as well as the objective visual improvement, strongly suggest that IPPB may be an important aid in the rehabilitation of post-operative thoracic surgery patients. In no case was IPPB found to be intolerable to the patient or prone to potentiate leaks following segmental resection.

CONCLUSION

A study has been presented indicating that intermittent positive pressure breathing treatments in the post-operative thoracic surgery patient appear to be a helpful adjunct in obtaining more rapid recovery.

*V. Ray Bennett Intermittent Positive Pressure Breathing apparatus used.
CONCLUSION

Se ha presentado un estudio indicando que los tratamientos por inhalación a presión positiva intermitente en el paciente en post-operatorio de cirugía torácica parecen ser un coadyuvante útil para la recuperación más rápida.

RESUME

Les auteurs présentent une étude montrant que les traitements par respiration sous pression positive intermittente dans la chirurgie thoracique post-opératoire semblent être un adjuvant efficace à l'obtention d'une guérison plus rapide.

SCHLUSSFOLGERUNG

In einer Arbeit wurde gezeigt, dass die postoperative intermittierende Überdruckbehandlung bei Lungenoperierten eine wertvolle Hilfe zur schnellen Wiederherstellung zu bedeuten scheint.

REFERENCES