A study of Yoga as a nursing intervention in the care of patients with pleural effusion

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‘Pranayama’ or yogic breathing as a method of re-expansion of lungs in patients with pleural effusion was studied. Ten patients with pleural effusion practised alternate nostril breathing for 20 days after aspiration of fluid. An equal number matched for age and smoking habits underwent routine physiotherapy of the hospital for the same period. Lung function was measured: before aspiration; immediately after aspiration; and, 5, 10, 15 and 20 days after aspiration. The FVC, FEV1, MVV, PEFR, CE and RS, were used to measure lung function. The difference between the two groups in the gain in lung expansion as assessed by the above measures was tested for significance with appropriate nonparametric statistical tests at 0.1 level of significance. The results revealed that the patients practising Pranayama demonstrated a quicker re-expansion of the lungs in most of the measures of lung function. The findings are discussed in relation to implications for nursing care.

INTRODUCTION

Maintenance of perfect physical and mental health was a very important aspect of ancient Indian spiritual rites as it was firmly believed that the body was the vehicle through which self-realization was achieved. The ancient sages believed that the air one breathed in was the most important life element for once this air deserted the body death ensued (Brahmananda 1972). Control over life was thought to be achieved if the flow of air in and out of the body was controlled. Hence, a method of restraining or controlling the breathing called ‘Pranayama’ was devised. Pranayama is described as the fourth limb of the eight-limbed yoga. According to patanjali yoga (the earliest organized form of yoga) pranayama meant breathing with a pause between the inhalation and exhalation after assuming a comfortable posture or ‘Asana’ (Tej Singh 1969). The present study aimed at finding the effect of this method of breathing on the re-expansion of lungs in patients with pleural effusion after liquid had been aspirated.

The available research literature on yoga and pranayama relevant to the present study can be broadly divided into those dealing with the effect of pranayama on healthy subjects and those studying its effect on patients with respiratory diseases. Miles (1964) showed that oxygen consumption was higher during yogic breathing or pranayama than during normal breathing and suggested the use of this method of breathing for acclimatization to high altitudes. His findings were further supported by measuring the difference in oxygen consumption at two different altitudes while a subject was performing normal and yogic breathing (Rao 1968). Vital capacity was found to be significantly higher in subjects practising yogic breathing (Bhole et al. 1970). Shabnag (1973) demonstrated an increase in

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chest expansion of one inch or more after 1 month of pranayama. Significantly higher values of vital capacity and breath-holding time were found in those who were trained in yoga and pranayama as compared to those who had only athletic training (Nayar et al. 1975).

Results of research on the effects of pranayama in respiratory diseases are also of interest. A study of patients with chronic asthma and chronic bronchitis showed that breath-holding time and transverse diameter of the chest were more and, the respiratory rate less in patients who had practised pranayama (Gopal et al. 1973). Bhole & Gharote (1977) demonstrated an increase in breath-holding time of 22 s with pranayama practice for 1 month in patients with bronchial asthma as compared to only 6 s without pranayama. A study of patients with severe airway obstruction revealed that the experimental group practising pranayama for a month had a significant increase in exercise tolerance, a quicker recovery after exertion and greater ability to control an attack of severe shortness of breath without medication, as compared to the control group who practised conventional chest physiotherapy (Tandon 1978).

THEORETICAL FRAMEWORK

In patients with pleural effusion the pleural cavity is filled with fluid to a lesser or greater extent. This restricts the normal expansion of the lungs. The lungs return to their normal expansion once the fluid is removed but this takes time and depends on retraining in deep breathing. It was hypothesized that pranayama or yogic deep breathing would help in quickening the process of re-expansion of the lungs in patients with pleural effusion after aspiration of fluid.

The framework chosen was based on the nursing process. It consisted of three phases: initial assessment of the patient, the choice and implementation of a nursing intervention

![Figure 1. Nursing process in the care of patients with pleural effusions.](image)
Yoga as a nursing intervention technique and, a final evaluation of the effectiveness of the technique. The assessment and evaluation consisted of objective and theoretical evidence. Nursing intervention included direct and indirect nursing actions (Murphy 1971). Pranayama was considered a direct nursing action. The relationship between these factors is demonstrated in Figure 1.

METHODOLOGY

It is essential for nursing intervention techniques to be experimentally tested before they can be used on patients. The pre-test/post-test/control group design, in a slightly modified form, was used in this study (Campbell & Stanley 1963). In the modified design, there was one measurement of lung function before aspiration of the fluid ($O_1$, $O_4$), a second one immediately after the aspiration ($O_2$, $O_3$) and, the third consisted of a series of measurements 5, 10, 15 and 20 days after aspiration ($O_5$, $O_6$).

$$R \cdot O_1 \text{ Aspiration } O_2 \cdot X \cdot O_3 \cdot$$
$$R \cdot O_4 \text{ Aspiration } O_5 - O_6 (X - \text{the experimental variable — pranayama}).$$

Twenty patients with uncomplicated pleural effusion were randomly selected from those admitted to a particular ward in a selected hospital for chest diseases and tuberculosis in Hyderabad, India, and were randomly assigned to control and experimental groups. The groups were located in two separate ward units in an attempt to avoid contamination. The criteria for selection of subjects were male patients; with a minimum of at least 100 ml of fluid on aspiration; with pulmonary tuberculosis between 16 and 50 years of age; admitted to the hospital under non-emergency conditions with no other complicating disease conditions. The two groups were matched for age and smoking habits.

Pranayama procedure

The experimental group of patients performed alternate nostril breathing or 'Anuloma–viloma pranayama' (the suryabhedana—chandrabhedana pranayama) for 30 min every morning for 20 days from day 1 to day 20 after aspiration. The patients sat in a slightly modified 'siddhasana' (a yogic posture), cross-legged with the right heel touching the perineum and the left ankle over the right heel. Both knees touched the ground; spine, neck and head were in a straight line giving maximum excursion to the diaphragm. The patients closed their eyes during the procedure since one of the pre-requisites to pranayama effectiveness was concentration on breathing. The left hand rested on the knee in a position called 'jnana mudra'. The right hand was used for closing the nostrils during pranayama. The right thumb was used to close the right nostril and the ring and little fingers together were used to close the left nostril. The index and the middle fingers were folded into the palm.

The procedure of anulomaviloma pranayama began after 5 min relaxation with both hands resting on the respective knees. Then the right nostril was closed with the right thumb and a deep breath was taken through the open left nostril. The left nostril was also closed with the ring and little fingers and the breath held for as long as the patient could without experiencing any discomfort. When the breath could no longer be held the right nostril was opened and the breath exhaled as slowly and completely as possible. After a pause a second breath was taken similar to the first but through the right nostril with the left nostril closed and later exhaled through the left. In this way the inhalation was always through the nostril through which the last exhalation was performed. This technique of breathing is described in great detail in yogic texts like the *Hathayoga Pradipika* (Panchan Sinh 1975) and the *Shiva Samhita* (Vasu 1975) and was chosen as it is recognized to be medically safe.

If the patients complained of fatigue during the procedure, a rest period of 3–5 min was given. The vital signs were noted at the beginning and end of the procedure to check for complications. The control group of patients underwent routine chest physiotherapy given in the hospital. The measures of lung function consisted of forced vital capacity (FVC), forced expiratory volume in 1 s (FEV$_1$), maximum voluntary ventilation (MVV), peak expiratory flow rate (PEFR), chest expansion (CE) and radiological score (RS). The first three were measured on Tosniwal expirograph (a 9-litre capacity wet spirometer); PEFR was recorded with a peak flow gauge, chest expansion was...
observed with the help of a tape marked in centimeters, and, the Radiological score was obtained on the basis of the number of lung zones involved in a miniature X-ray film. A proforma was prepared to collect descriptive data of all the patients and also to record the values of lung function on six time periods i.e. before aspiration, immediately after aspiration, and 5, 10, 15 and 20 days after aspiration. But, X-rays were taken only before aspiration and at the end of 20 days to avoid over exposure. Three patients each in experimental and control groups similar to sample subjects were selected for participation in the pilot study.

ANALYSIS AND DISCUSSION

Non-parametric statistical tests of significance were chosen for analysis and interpretation of results. The probability statements obtained from most of the non-parametric tests are exact probabilities regardless of the shape of the population distribution from which the sample is drawn. In a small sample, as in this study, these tests were considered appropriate. The level of significance was set at 0.1 as it was not possible to control all the extraneous variables. Four hypotheses were formulated and tested for significance.

The first hypothesis stated that respiratory function immediately after-aspiration as measured by FVC, FEV₁, MVV, PEFR and CE would be greater than that before aspiration. The single group sign test was applied to the data since the hypothesis did not differentiate between the experimental and control groups. The null hypothesis was rejected only with the measure of PEFR. This showed that a significantly greater number of patients had an increased PEFR after the aspiration of the fluid.

The reason for significant gain only in one value (PEFR) and not in others can be explained in terms of the difference in amount of strain on the patients while doing the test on the peak flow gauge and the expirograph spirometer. With the gauge the patients were more free and were not required to breathe as forcefully and continuously as for the spirometric tests. The fear of pain and injury to the internal organs could have restricted the forceful exhalation during spirometry.

The second hypothesis stated that the rate of re-expansion of the lungs would be faster in patients practising pranayama than in those not practising pranayama as measured by FVC, FEV₁, MVV, PEFR and CE. The randomization test was used as this was the most powerful non-parametric test for two small independent groups and its power efficiency was 100% as it used all the information from the samples (Siegel 1956). The mean gain values of each measure after 5, 10, 15 and 20 days were computed for the experimental and control groups using the values immediately after aspiration as baseline data. The sum of the mean gains was calculated separately and the difference in the sums of the mean gains was tested for significance if it fell within the seven most extreme possible outcomes. The difference in gains in FVC of 601 ml and CE of 5-9 cm were found to be highly significant. The gain difference in PEFR of 78 l/s just missed the region of rejection. The changes in FEV₁ and MVV were negligent.

The reason why no gain was seen in the FEV₁ and MVV could be that these were indices more of obstructive defect of the lungs than restrictive defects. Based on

![FIGURE 2. FVC gain. In the experimental group (—), FVC gain was consistently higher — being more than double that of the control group (---) 5 and 10 days after aspiration. This was highly significant at 0.1 level.](image-url)
Yoga as a nursing intervention

the findings of FVC and CE measures it can be said that the lung expansion was quicker in patients who practised pranayama than in those who did not practice it.

The third hypothesis was that the total lung expansion would be greater in patients practising pranayama than in those not practising it as tested by all the measures of lung function. The difference in the values of the day immediately after aspiration and 20 days after aspiration were tested for significance with the help of the Kolmogorov-Smirnov test and the Fisher exact probability test (Siegel 1956). None of the results showed any significant difference. However, the
means did show a positive difference with regard to FVC, PEFR and CE though these were not significant when the Kolmogorov-Smirnov test was applied as seen in Table 1. The difference in mean gains, 20 days after aspiration, between experimental and control groups in FEV$_1$ and MVV were negative.

**TABLE 1**

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Experimental</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC (ml)</td>
<td>348</td>
<td>483</td>
<td>135</td>
</tr>
<tr>
<td>FEV (ml)</td>
<td>249</td>
<td>233</td>
<td>-16</td>
</tr>
<tr>
<td>MVV (l/min)</td>
<td>12.5</td>
<td>8.72</td>
<td>-3.78</td>
</tr>
<tr>
<td>PEFR (l/s)</td>
<td>86</td>
<td>113</td>
<td>27</td>
</tr>
<tr>
<td>CE (cm)</td>
<td>1.4</td>
<td>3.3</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Conclusions: The significant changes observed with regard to the rate of re-expansion of the lungs showed that there are specific implications for nursing care and hospital administration. The measures of lung function like FVC, PEFR and CE showed faster rise in the experimental group as compared to the control group indicating that lung expansion was faster in patients practising pranayama than in those who had the routine chest physiotherapy. However, the aim of the study was not to prove that one method is superior to another but to reveal the potential of other techniques. There is a possibility that if patients were taught to use pranayama after aspiration of fluid the rehabilitation phase would be quicker; thereby the duration of their stay in the hospital would be reduced making beds available to patients in need of acute care. The positive correlation between the amount of fluid aspirated and the gain in FVC in the experimental group could mean that there are possibilities of this type of breathing being of greater use to patients with massive effusions. It is also observed that the patients practising pranayama showed great enthusiasm for the technique and voiced their liking for it. Pranayama as a breathing technique has advantages over the other methods in its closer association with cultural traditions of various communities in India. It is a type of breathing which can be mastered with a little effort. Its
teachers do not need extensive and expensive training. Above all, it is a non-invasive technique. The use of traditional systems of health care to help achieve health for all by 2000 AD is being stressed. Developing countries may need to incorporate traditional methods into the general health services wherever it is found to be acceptable.

Further studies

It is suggested that further studies in this area be taken up to study the use of pranayama as a nursing intervention in such areas as health promotion, post-operative care, long-term care for bedridden patients, care of patients with chronic pulmonary conditions, rehabilitative care of cardiac patients, and, as a relaxing technique in psychiatric care.

Some of the limitations of the present study restrict the generalizations that can be drawn from the results. The sample size was very small and stringent control over the extraneous variables was not possible for ethical reasons. It was not possible to control the contamination of the control group with information from the experimental group as on occasions the convalescent patients got together in the hospital garden. It is essential that similar studies on larger and varied groups be conducted before definite conclusions can be drawn.

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