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Pulmonary function after radical mastectomy

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Abstract

This study investigates whether or not the resection of the pectoralis major following radical mastectomy for breast cancer affects pulmonary function.

In sixteen patients who underwent elective radical mastectomy, postoperative %VC and FEV_{1.0} % values were lower than preoperative values. The reduction rate of %VC was significantly greater than that of FEV_{1.0} % after radical mastectomy. But, there was no significant correlation. Postoperative pulmonary complication did not occur in any patient. As for pulmonary functions, %VC was reduced after radical mastectomy; however, postoperative pulmonary complication did not occur in any patient with normal pulmonary function prior to surgery.

Key words : radical mastectomy, pulmonary function, pulmonary complication

Introduction

Since breast cancer is the most common malignancy among Japanese women, many studies have been conducted on its treatment. Classically, radical mastectomy for advanced breast cancer, and recently, modified radical mastectomy or quadrantectomy of the breast for relatively early stages of breast cancer, have been carried out in Japan¹⁻⁴. In cases of radical mastectomy, both the pectoralis major and minor muscles are resected. It is presumed that a patient with a resected pectoralis major will have a functional disturbance of the arm. To prevent this, postoperative rehabilitation has usually been done. The pectoralis major muscle, however, has also been recognized as an important muscle for respiration⁵. This study investigates whether or not resection of the pectoralis major after radical mastectomy affects pulmonary function.

Patients and Methods

Patients

Sixteen patients who underwent radical mastectomy for breast cancer at the Second Department of Surgery, Kumamoto University Hospital, were studied. Table 1 summarizes their clinical features. From 40 to 59 years old, they were underwent radical mastectomy without parasternal lymph node dissection. None had cardio-pulmonary disease prior to surgery, or showed any abnormal pulmonary function. Also, none had developed any wound complications or showed any disturbance of arm movement, and none underwent postoperative radiation treatment. Their average age was 49.6 ± 6.1 years old. Twelve patients had advanced breast cancer, while four were still in early stages.

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Table 1. Cases

Case	Age	Stage
1	49	advance
2	42	early
3	46	advance
4	42	advance
5	55	advance
6	51	advance
7	42	advance
8	48	early
9	59	advance
10	54	advance
11	50	early
12	41	early
13	46	advance
14	57	advance
15	59	advance
16	53	advance

advance : advanced
breast cancer
early : early breast cancer

Table 2. %VC

Case	Preoperation	Postoperation
1	90.0	73.2
2	123.0	94.5
3	89.0	80.4
4	105.2	95.2
5	92.3	82.6
6	98.6	82.1
7	113.2	86.2
8	123.6	82.2
9	86.2	67.4
10	92.8	80.8
11	84.2	74.2
12	111.6	94.2
13	86.6	74.2
14	90.8	76.2
15	80.4	80.2
16	90.8	77.6

(%)

Methods

We investigated the difference between pre- and post-operative pulmonary function, that is, the percentage of vital capacity (%VC) and the percentage of forced expiratory volume for one second (FEV_{1.0} %) by a Mela-EV spirometer. All spirometer tests, both pre- and post-operatively, were performed with the patient sitting on a chair and with nose-clip occlusion. Each spirometric determination were done four times, and the highest value was adopted. The postoperative pulmonary function was surveyed four times immediately before discharge from the hospital, which, averaged 20.1 days (range from 16-27) after the operation. The reduction rates of %VC and FEV_{1.0} % were obtained by calculating the percentage of difference between pre- and post-operative values, using the following formula :

$$RR\text{-}\%VC = (PRE\text{-}\%VC - POS\text{-}\%VC) / PRE\text{-}\%VC \times 100 \text{ (per cent)}$$

$$RR\text{-}FEV_{1.0} \% = (PRE\text{-}FEV_{1.0} \% - POS\text{-}FEV_{1.0} \%) / PRE\text{-}FEV_{1.0} \% \times 100 \text{ (per cent)}$$

RR-%VC : reduction rate of %VC

RR-FEV_{1.0} % : reduction rate of FEV_{1.0} %

PRE-%VC : preoperative %VC

POS-%VC : postoperative %VC

PRE-FEV_{1.0} % : preoperative FEV_{1.0} %

POS-FEV_{1.0} % : postoperative FEV_{1.0} %

Results were expressed as mean \pm SD. The Student's t-test was used for statistical analysis. A p value of less than 0.05 was considered significant.

A patient was deemed to have developed a postoperative pulmonary complication if, while in hospital, there developed a productive cough with fever of 37 °C or more, with physical signs upon chest examination.

Results

Preoperative and postoperative %VC

Table 2 shows the actual pre- and post-operative values recorded for the %VC. Each of the preoperative %VC values revealed no abnormality. The average preoperative %VC value was $97.4 \pm 13.7\%$, and postoperative average %VC value of the patients was $81.3 \pm 8.0\%$. Most patients' postoperative %VC values were

Table 3. FEV_{1.0}%

Case	Preoperation	Postoperation
1	80.6	66.4
2	81.6	74.5
3	80.8	77.6
4	86.9	75.7
5	91.0	94.2
6	84.0	86.4
7	93.3	89.6
8	78.2	74.5
9	76.3	78.8
10	84.0	80.3
11	79.2	76.3
12	90.4	89.8
13	78.2	82.4
14	72.8	70.4
15	76.2	70.2
16	84.2	79.8

(%)

normal, except for a 73.2 % in case 1, a 67.4 % in case 9, a 74.2 % in case 11, a 74.2 % in case 13, and a 76.2 % in case 14. We found that postoperative %VC was significantly lower than preoperative ($p < 0.001$). The postoperative reduction rate was 15.8 ± 7.5 % for %VC.

Preoperative and postoperative FEV_{1.0} %

Pre- and post-operative FEV_{1.0} % values are shown in Table 3. The average preoperative FEV_{1.0} % value was 82.4 ± 5.8 %. No pre- and post-operative FEV_{1.0} % values were abnormal, except for a postoperative 66.4 % in case 1. The average postoperative FEV_{1.0} % value was 79.2 ± 7.7 %, significantly lower than the preoperative ($p < 0.05$). The postoperative reduction rate was 3.9 ± 3.9 % for FEV_{1.0} %. There was a statistical difference between reduction rates of %VC and FEV_{1.0} % ($p < 0.001$), but no significant correlation.

Postoperative pulmonary complication

Despite the reduction in postoperative %VC value, the pulmonary complications of pneumonia, atelectasis, or abnormal blood gas level, did not occur postoperatively.

Discussion

The Pectoralis major connects to the clavicle, sternum, the first, second, third, fourth, fifth and sixth ribs, and to the rectus sheath. For respiration, the pectoralis major muscle aids the vertical motion of the ribs⁵. The pectoralis minor connects to the third, fourth, and fifth ribs, and to the coracoid process of the scapula, which does not have any pulmonary function. It is presumed that pulmonary function are usually reduced after surgery with general anesthesia^{6,7}. The reduction is especially prominent after upper abdominal surgery^{8,9}. However, we were not able to find any reports about influence on pulmonary function or about pulmonary complication after resection of the pectoralis major. Accordingly, we studied the affect of resection of the pectoralis major on the pulmonary function following radical mastectomy for breast cancer.

%VC reflects the distension of the lung from the movement of thorax and diaphragm. A %VC value less than 80 %, called restrictive ventilatory impairment, occurs in diffuse interstitial pneumonitis, pulmonary tuberculosis, pneumonitis, pulmonary edema, hydrothorax, pleural callosity, pneumothorax, paralysis of the diaphragm, and obesity. It is also reported that postoperative pulmonary complication frequently occurs in such patients, especially, when the %VC value is below 50 %¹⁰⁻¹². In each our cases and on the average, postoperative %VC value was significantly lower than the preoperative value ($p < 0.001$). Especially in five cases (case 1, 9, 11, 13, and 14), postoperative %VC values indicated an abnormal rate, indicating restrictive ventilatory impairment. In these cases, however, there was no postoperative pulmonary complication.

FEV_{1.0} % reflects the coughing power in a moment, which is under the control of the airway

resistance. An $FEV_{1.0}$ % value less than 70 %, called obstructive ventilatory impairment, occurs in bronchial asthma, chronic bronchitis, and pulmonary edema. It is also reported that postoperative pulmonary complication frequently occurs in such patients, especially when the $FEV_{1.0}$ % value is below 50 % postoperatively¹⁰⁻¹²). In our cases, the average postoperative $FEV_{1.0}$ % was decreased, the difference was significant. Surprisingly, in five cases, postoperative $FEV_{1.0}$ % was increased. There was only one (case 1) with an $FEV_{1.0}$ % below normal range ; however, no postoperative pulmonary complication occurred. The feature of this case was obesity (147 cm in height and 72 kg in weight).

The reduction rate of %VC was significantly greater than that of $FEV_{1.0}$ % after radical mastectomy ($p < 0.001$). But, there was no significant correlation. Therefore, it is clear that %VC reduced more than did $FEV_{1.0}$ % in pulmonary function after the resection of the pectoralis major.

It is necessary to survey pulmonary function immediately after operation any surgery which is followed by pulmonary complication. However, reduced VC may also be due to incision pain or to the influence of general anesthesia. The time for full recovery of the VC to preoperative level is unknown, but it appears to be in excess of three weeks. Therefore, in our cases, postoperative pulmonary function was surveyed again immediately before discharge from the hospital, which averaged 20.1 days from day of surgery. Two cases (cases 1 and 9), and their pulmonary functions were below normal range.

It is reported that postoperative pulmonary complications occur three times more frequently in the presence of pre-existing respiratory disease, and there is also evidence to suggest that the frequency of postoperative pulmonary complications over the age of 70 may be related to this factor¹³). In our cases, despite abnormality in the postoperative respiratory function, no pulmonary complications occurred. We concluded that the reason for this was follows : radical mastectomy was a low-loaded operation for the patients. After radical mastectomy, they left their bed and moved earlier than patients of the other operations such as those on the upper abdominal region. Also, cases below the age of 60 and with normal pulmonary function in the preoperative state were selected.

However, in patients over the age of 70 and with low %VC and/or $FEV_{1.0}$ % values, both below 50 %, pulmonary complication after radical mastectomy is likely to occur.

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