

Assessment of shoulder mobility in women over 60 years of age after one-sided mastectomy

Ocena funkcji barku u kobiet po 60. roku życia leczonych z powodu raka piersi

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Key words

mastectomy, shoulder, muscle strength, Range of Motion (ROM), aged

Abstract

Introduction: The overall risk of contracting various diseases, including breast cancer, increases with age. An on-going process of population ageing challenges modern physiotherapy with the need to have functional capacity in older people appreciably enhanced. The issue of anthropometric assessment of the range of motion and shoulder muscle strength is presently much underrated in the physical rehabilitation management of women patients after radical one-sided mastectomy.

Aim of the study: The study aimed to assess the functional mobility of a shoulder expressed as a range of motion, in conjunction with the assessment of shoulder muscle strength, in women patients over 60 years of age after radical one-sided mastectomy.

Methods: The study comprised 24 patients (mean age 65 years) recruited from the Department of Rehabilitation, Holy Cross Cancer Centre, Kielce. All patients had undergone modified radical mastectomy using the Madden technique, and an adjuvant therapy. The shoulder range of motion, i.e. flexion, abduction, internal and external rotation, was evaluated by a goniometer. Elevation, protraction and retraction movements were evaluated using an anthropometric device. A dynamometer was applied to assess the strength of select muscle groups within the shoulder during elevation, protraction and retraction motions. Statistical analysis was made with the aid of STATISTICA 12.0 software, having adopted a 0.05 alpha level as statistically significant.

Results: The movements of flexion, abduction and external rotation of the upper extremity were significantly reduced on the mastectomy side. The range of motion and muscle strength during shoulder elevation, protraction and retraction were significantly diminished on the operated side (12% - 14%), compared to the non-operated one.

Conclusions: 1. Functional mobility of the shoulder was significantly reduced on the mastectomy side. 2. Results of the present study highlight the need to extend the scope of rehabilitation regimens offered to older women after radical one-sided mastectomy.

Słowa kluczowe

mastektomia, bark, siła mięśniowa, zakres ruchomości, osoby starsze

Streszczenie

Wstęp: Z wiekiem wzrasta ryzyko zachorowania na różne choroby, w tym raka piersi. Postępujący proces starzenia się społeczeństw wymaga od współczesnej fizjoterapii zwiększenia sprawności funkcjonalnej osób starszych. Problem antropometrycznego pomiaru zakresu ruchu oraz siły mięśni barku jest słabo dostrzegany w procesie usprawniania pacjentek po mastektomii.

The individual authors contributed to this paper in the following way: A – research work project; B – data collection; C – statistical analysis; D – data interpretation; E – manuscript compilation; F – publication search

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Cel pracy: Celem badania była ocena funkcji barku wyrażonej w zakresie ruchu i siły mięśniowej u pacjentek po 60. r.ż., po mastektomii.

Material i metody: Do badania zakwalifikowano 24 pacjentki (średnia wieku: 65 lat) w Zakładzie Rehabilitacji Świętokrzyskiego Centrum Onkologii w Kielcach. Wszystkie pacjentki były poddane zmodyfikowanej radykalnej mastektomii metodą Madena oraz odpowiedniemu leczeniu uzupełniającemu. W Zakładzie Rehabilitacji zbadano zakres ruchomości stawów ramiennolopatkowych podczas zgięcia, odwiedzenia, rotacji wewnętrznej oraz rotacji zewnętrznej za pomocą goniometru. Ruchy unoszenia, wysuwania do przodu (protrakcja) oraz cofania (retrakcja) barku oceniano za pomocą antropometru. Dynamometrem zbadano siłę wybranych grup mięśni barku podczas unoszenia, wysuwania do przodu oraz cofania. Analizę statystyczną wykonano za pomocą pakietu STATISTICA 12.0, przyjęto poziom $\alpha = 0,05$.

Wyniki: Ruchy zgięcia, odwodzenia i rotacji zewnętrznej kończyny górnej były istotnie statystycznie ograniczone po stronie operowanej piersi. Zakres ruchu oraz siła mięśni barku podczas unoszenia, wysuwania do przodu i cofania były istotnie statystycznie mniejsze po stronie wykonanej mastektomii (12-14%) w stosunku do strony zdrowej.

Wnioski: 1. Funkcja barku u kobiet po 60. roku życia, po stronie operowanej piersi jest znacząco ograniczona. 2. Przedstawione badania wskazują na konieczność poszerzenia zakresu rehabilitacji chorych w starszym wieku po leczeniu raka piersi.

INTRODUCTION

The risk of breast cancer in women over the age of 60 is 3.54%, and rises to 3.84% over the age of 70, being the greatest risk in the studied age groups¹. Along with advancing age, a decrease in the five-year survival rate is also noticed. In the 60-69-year-old age group, it is 91%, whereas for the over-80s, it is 64%².

In the last 40 years, the average percentage of women with breast cancer who survive 5 years after diagnosis has doubled from 25% to 50%. According to the American Cancer Society, between 2005 and 2011, the five-year survival rate for breast cancer was 1.5% higher in comparison to the measurements conducted in the period spanning 2002 - 2004³. Increased survival is associated mainly with improved treatment methods and earlier detection of this disease^{4,5}. In about 40% of women after mastectomy, however, at least one functional loss of the shoulder is noted. Furthermore, anthropometric measurements of the range of motion and shoulder muscle strength do not feature prominently enough in the process of rehabilitation of patients after breast cancer treatment. It is therefore essential to put an extra focus to functional fitness in elderly women after mastectomy.

The present study aimed to evaluate the function of the shoulder, expressed in range of motion and muscle strength in patients over 60, after radical treatment for breast cancer.

METHODS

The data was collected during research conducted at the Department of Physiotherapy of the Holy Cross Cancer Centre in Kielce. The study enrolled 24 patients over the age of 60, who, both at the time of the study, as well as prior to the commencement of the treatment, did not feel any pain, dysfunction or restriction of shoulder mobility on the operated or non-operated side, according to their own subjective assessment. Inclusion criteria were: age (≥ 60 years), time passed since mastectomy (≥ 2 years), and the absence of lymphatic edema (greater than 3 cm between the upper limbs) noted during examinations. All patients actively participated in the physical rehabilitation programme used at the Department of Physiotherapy of the Holy Cross Cancer Centre. The rehabilitation programme comprised physical therapy during the hospitalisation (preoperative, postoperative) and ambulatory period, and described in a different publication⁶.

Methods

The study was prospective. The medical records of medical history, clinical classification of breast cancer and the result of pathomorphological breast and lymph node tests were analysed. Data was collected for adjuvant treatment: chemotherapy, radiation therapy, hormonal therapy. A clinical study was conducted at the

Department of Rehabilitation of the Holy Cross Cancer Centre in Kielce, making use of commonly applicable measuring equipment, both for testing adults and children.

Following standard practice, radiation therapy was applied using the conformal mixed photon-electron beam technique with a total dose of 4500 cGy, where the fractional dose was 225 cGy, and the number of fractions was 20.

The evaluation of motion of the upper limbs was assessed using a goniometer. The range of movement was determined by the ISOM (International Standard Orthopedic Measurement), and the results saved to an SFTR system (Sagittal Frontal Transverse Rotation) for the following movements: flexion, abduction, internal and external rotation of the upper limbs on the operated and nonoperated sides. Measurements were made in compliance with generally accepted methodology⁷.

Muscle strength was assessed using a CURSOR ISOBEX 3.1 dynamometer which was attached to the ground with suction cups. For every movement, it took 3 measurements of isometric tension maintained for 3 seconds. The mean value was used for analysis and the results recorded in kilograms (kg). The strength of selected muscle groups in the shoulder was tested during elevation, protraction and retraction in line with the methodology for dynamometric measurements of specified movements^{8,9}. The research was approved by the Insti-

tute for Scientific Research Ethics - “The Polish Mother’s Health Care Institute” in Lodz, in December 2009 (Approval doc. ref. no L.Dz.280/Pch/2070/09).

Data analysis

Statistical analysis was completed using the STATISTICA PL v12 package for Windows. Data distribution was examined using the Shapiro-Wilk test ($n < 100$). Descriptive statistics comprised: arithmetic mean, standard deviation, and percentage distributions. The Student t-test and the Mann-Whitney test were applied, depending on the distribution of variables. The statistically significant level was adopted at $\alpha = 0.05$.

RESULTS

Basic description of the study participants

The study comprised patients over the age of 60 (mean 65.4 years), on average, three years after the radical mastectomy procedure. More than 65% of subjects had their left side surgically treated and more than 80% of the women underwent chemotherapy after surgery. More than 65% of patients received adjuvant therapy in the form of radiation and hormone therapy. A complete description is shown in Table 1.

The range of movement in the basic patient description differed significantly between the operated and non-operated limbs in the movements of flexion, abduction and external rotation: 4.4°, 3.5°, 4.5°, respectively.

The range of motion expressed in centimetres during elevation, protraction and retraction movements differed significantly in all these movements: 0.7 cm, 0.6 cm, 0.8 cm, respectively.

The shoulder muscle strength during lifting (a difference of 1.8 kg), protraction (a difference of 1.21 kg) and retraction (a difference of 0.85 kg) differed significantly on the operated side of the breast in relation to the non-operated side.

Table 1

Description of the study group		
Baseline characteristics of the study group		
Variable	N=24	p
Age (years), $x \pm SD$	65.4 \pm 4.4	-
Height (m), $x \pm SD$	1.63 (9.4)	-
Weight (kg), $x \pm SD$	69.5 (9.4)	-
BMI (kg/m ²), $x \pm SD$	26 (3.21)	-
Time since surgery (years) $x \pm SD$	3.4 (1.5)	-
Operated side L/R (%)	70.8/29.2	-
Education (%)		
Primary	8.3	-
Occupational	8.3	-
High-school	66.7	-
Higher	16.7	-
Adjuvant therapy yes, (%)		
Chemotherapy before*	20.8	-
Chemotherapy after**	83.3	-
Radiation therapy	70.8	-
Hormonal therapy	66.6	-
Upper-limb range of motion Op/H mean		
Flexion (°)	163.5/167.9	<0.01
Abduction (°)	164.8/168.3	<0.01
Internal rotation (°)	75/77.4	0.07
External rotation (°)	82.9/87.4	<0.01
Shoulder range of motion		
Elevation (cm) mean	8.9/9.6	<0.01
Protraction (cm) mean	7.6/8.2	<0.01
Retraction (cm) mean	5.3/6.1	<0.01
Shoulder muscle strength Op/H, mean (kg)		
Shoulder elevation	11.8/13.1	<0.001
Shoulder protraction	7.1/8.3	<0.001
Shoulder retraction	5.5/6.4	<0.001

L – left, R – right, * chemotherapy before surgical procedure, ** chemotherapy after surgical procedure, Op – Operated, H – Healthy

DISCUSSION

The study aimed to assess the range of motion and shoulder muscle strength of selected shoulder muscle groups after radical mastectomy in women over the age of 60. The patients, examined 3 years after the surgical procedure, had a significantly limited range of motion of the upper limb on the operated breast side during flexion, abduction and external rotation; this also corroborated by other authors. Furthermore, the range motion of the shoulder when elevating, and during protraction and retrac-

tion of the shoulder, was statistically significantly smaller on the side of the radical mastectomy in relation to the non-operated side. Shamley et al.¹⁰, who studied the electromyographic activity of the upper-limb muscles, noted the weakening of serratus anterior and the pectoralis minor muscle activity in the upper limb on the side of the mastectomy.

The deterioration in serratus anterior muscle efficiency was associated with the instability of the shoulder on the operated side¹⁰. The strength of the shoulder girdle on the operated side, compared to the healthy side

appears to be significantly weakened in each of the tested movements. The muscle strength during elevation, protraction and, retraction of the shoulder was lower on the side of the mastectomy 3 years after the procedure, by 13.8%, 14.5% and 13.3%, respectively.

Restricted mobility and upper limb muscle strength after the mastectomy was also observed by others investigators¹¹⁻¹³. Nevertheless, Springer et al.¹⁴ noted that full mobility of the upper limb and muscle strength should return 12 months following the procedure. In the summary of their cohort study lasting 2.5 years, Sagen et al.¹⁵ say that decreased grip strength of the hand muscles ranging from 2 to 12% may occur, while Rietman et al.¹⁶ expand this range of decreased hand muscle grip strength to 31%. Furthermore, it should be noted at this juncture that in 70% of patients admitted into the study, adjuvant therapy in the form of radiation therapy was introduced. The chest area and regional lymph nodes were irradiated for 4 weeks, every day, from Monday to Friday. As irradiation targeted the chest and regional lymph nodes, it might well be instrumental in causing fibrosis of soft tissue in the area of the anterolateral chest wall, and thus weaken the strength of the pectoral and serratus anterior muscles, causing twisting of collagen fibres, and consequently, limiting the function of the shoulder.

Considering the result of the functional restrictions, the age of the women (65 years) should be taken into account. Satariano et al.¹⁷ examine the impact of age on functional limits stating that women after mastectomy a 10 years younger than the patients comprised in the study are twice less likely to report limitations, which must be construed as lack of, or incomplete execution of strength in motor activity subjected to evaluation of 0 to 4 points of the upper limb. The rotator cuff consists of the following muscles: supraspinatus, infraspinatus, teres minor and the subscapularis, which need adequate subacromial space to perform rotation, and which may be limited by a higher than usual positioning of the scapula

(a shortening of the serratus anterior muscle, limiting rotation)^{9,18}. Furthermore, the shoulder joint is part of a biokinematic chain and any restrictions, or overloads trigger changes in the adjacent chains. This can affect static and dynamic disorders of the trunk and, consequently, lead to unnatural body posture, or even falls.

The function of the shoulder joint is not only executive, but also protective. About 33% of the elderly fall at least once a year, including twice as many women than men¹⁹. Falls may result in fractures, amongst which the fractures of the femoral neck and distal epiphysis of the radius prevail²⁰. The study highlights the need to effectively broaden the scope of physical rehabilitation regimens offered to the patients after radical mastectomy, through introducing a range of techniques mobilising the shoulder and enhancing muscle strength responsible for its movements.

CONCLUSIONS

1. The shoulder function in women over the age of 60 on the side of the mastectomy is appreciably limited.
2. The present study highlights the need to broaden the scope of physical rehabilitation regimens offered to the elderly patients after radical breast cancer treatment.

Conflict of interest: none declared

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