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ANTHROPOMETRIC AND THORACIC CHANGES IN MIDDLE-AGED AND ELDERLY WOMEN 12, 24, AND 36 MONTHS AFTER MASTECTOMY WITH THE USE OF THERAPEUTIC EXERCISE

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Abstract

This study analyzes the dynamics of anthropometric and thoracic parameters in middle-aged and elderly women during rehabilitation following mastectomy over a 36-month period, with a focus on the effects of therapeutic physical exercise (TPE). A total of 120 women were included, divided into two age groups: middle-aged (45–59 years) and elderly (60–74 years). Measurements were conducted at 12, 24, and 36 months post-surgery. Anthropometric parameters such as height, body weight, BMI, torso length, and sitting height were assessed. In addition, chest circumference at rest, during inhalation and exhalation, and chest excursion were evaluated. Statistically significant improvements were observed in both groups, especially among middle-aged women, with a consistent decrease in body mass and BMI, along with more stable values in chest expansion and circumference over time. Chest excursion showed a slight but persistent improvement in both age groups. These findings suggest that regular application of therapeutic exercise post-mastectomy contributes positively to the stabilization and improvement of key morphometric indicators, supporting the role of physical rehabilitation in long-term recovery. Data were statistically processed using mean ± SD and p-values, confirming intergroup and intragroup significance ($p<0.05$; $p<0.01$). The results can inform rehabilitation protocols to optimize recovery outcomes after breast cancer surgery.

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Keywords: Mastectomy, physical therapy, anthropometry, chest circumference, rehabilitation, breast cancer, elderly women, middle-aged women, chest excursion, BMI.

Relevance

Breast cancer is the most commonly diagnosed cancer among women worldwide and remains a leading cause of cancer-related mortality. Surgical treatment, particularly mastectomy, plays a central role in the management of breast cancer but is often associated with significant postoperative complications. These may include shoulder dysfunction, thoracic deformities, chronic pain, lymphedema, and decreased respiratory function. Beyond oncological outcomes, the physical and psychological recovery of patients following mastectomy is a major challenge, especially among older women.The process of physical rehabilitation post-mastectomy is essential to restore musculoskeletal balance, respiratory mechanics, and overall physical functionality. Therapeutic physical exercise (TPE) has emerged as one of the most effective strategies in this context. It not only addresses the mechanical deficits resulting from surgery but also improves the patient's quality of life, autonomy, and emotional well-being. However, age-related differences in recovery potential remain understudied. While middle-aged women may respond more favorably to exercise interventions, elderly patients often present with reduced functional reserves, chronic comorbidities, and decreased adaptability to physical stress, all of which can influence rehabilitation outcomes.In Uzbekistan and other regions with similar healthcare infrastructures, post-mastectomy rehabilitation is not yet standardized, and long-term monitoring of recovery trajectories is limited. There is a pressing need to evaluate how age affects anthropometric changes and thoracic function over time in women who undergo mastectomy. Longitudinal data on anthropometric parameters—such as height, body weight, BMI, torso length, and chest circumference at various phases of respiration—can provide essential insights into the physical consequences of mastectomy and the compensatory mechanisms induced by exercise therapy. Furthermore, thoracic excursion is a clinically relevant parameter that reflects the mechanical capacity of the chest wall and lungs. Reduced excursion is associated

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with limited pulmonary ventilation, restricted shoulder movement, and impaired postural dynamics—all of which can deteriorate a patient's daily functioning. Monitoring chest circumference and excursion over time allows clinicians to evaluate the effectiveness of rehabilitation programs and detect age-related declines in thoracic mobility.This study is particularly relevant as it compares middle-aged and elderly women across 12-, 24-, and 36-month intervals after mastectomy, highlighting the sustainability and limitations of therapeutic physical exercise over extended periods. By identifying which parameters improve and which remain stable or decline, healthcare providers can individualize rehabilitation approaches and set realistic recovery goals based on age and functional capacity.Moreover, the findings can inform public health policy, especially in countries where post-cancer rehabilitation is not yet fully integrated into oncology care. Establishing a database of normative and pathological anthropometric changes post-mastectomy can serve as a benchmark for clinical evaluation and treatment planning.In conclusion, this study fills a crucial gap in understanding how structured physical therapy influences the long-term physical outcomes of mastectomy in women of different age groups. It emphasizes the importance of age-sensitive rehabilitation strategies and provides evidence to support the inclusion of therapeutic physical exercise in national standards for comprehensive cancer care.

Objective:

To assess the long-term dynamics of anthropometric and chest circumference parameters in middle-aged and elderly women at 12, 24, and 36 months following mastectomy, and to evaluate the effectiveness of therapeutic physical exercise in restoring physical functionality and structural balance.

Materials and Methods

This prospective observational study included 120 female patients who underwent radical mastectomy due to breast cancer between 2020 and 2022. All participants were enrolled in a standardized postoperative rehabilitation program that incorporated therapeutic physical exercise (TPE) as a core intervention. The

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patients were divided into two age-based cohorts: middle-aged women (n=60; aged 45–59 years) and elderly women (n=60; aged 60–74 years). Each participant was assessed at three follow-up intervals: 12, 24, and 36 months post-mastectomy.Inclusion criteria were: completed radical mastectomy, absence of recurrence or metastasis, absence of physical disabilities unrelated to cancer, and consent to participate in long-term follow-up. Exclusion criteria included significant cardiopulmonary diseases, neurological impairments, and lack of adherence to the exercise protocol.All patients followed a personalized TPE program, designed by a certified physiotherapist, which included breathing exercises, posture correction, shoulder girdle mobilization, and thoracic expansion techniques. Sessions were held three times per week during the first year and twice per week in subsequent years.Anthropometric measurements included standing height (cm), body weight (kg), BMI (kg/m²), sitting height, and torso length. Thoracic parameters included chest circumference at rest, during inhalation and exhalation, and chest excursion (difference between inhalation and exhalation).Measurements were conducted by trained medical personnel using standard anthropometric tools. Each parameter was measured three times, and the average value was recorded to ensure reliability. All data were documented using a unified protocol.Statistical analysis was performed using SPSS version 26.0. Descriptive statistics were calculated (mean ± standard deviation). Intragroup and intergroup comparisons were conducted using paired and unpaired t-tests. A p-value of <0.05 was considered statistically significant, and $p<0.01$ was considered highly significant.

Ethical approval was obtained from the institutional review board, and all patients provided written informed consent prior to participation.

Results

Throughout the 36-month observation period, both middle-aged and elderly women who had undergone mastectomy and participated in a structured therapeutic physical exercise (TPE) program demonstrated gradual yet significant changes in thoracic anthropometric parameters.Chest circumference at rest in middle-aged women decreased slightly from 90.7 ± 0.7 cm at 12 months to 89.1

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± 0.7 cm at 36 months. In elderly women, this value decreased more notably from 84.0 ± 0.8 cm to 82.2 ± 0.8 cm during the same timeframe. Chest circumference during inhalation showed a similar downward trend: from 96.0 ± 0.6 cm to 94.4 ± 0.6 cm in the middle-aged group and from 87.5 ± 0.7 cm to 85.7 ± 0.7 cm in the elderly group.Measurements during exhalation followed a consistent pattern. Among middle-aged women, it decreased from 90.9 ± 0.6 cm to 89.3 ± 0.6 cm, while in the elderly cohort it declined from 82.5 ± 0.7 cm to 80.7 ± 0.7 cm between the 12th and 36th months.Thoracic excursion, a key indicator of chest mobility and respiratory function, remained relatively stable throughout the study. For middle-aged women, it showed a modest decline from 4.0 ± 0.1 cm at 12 months to 3.8 ± 0.1 cm at 36 months. In the elderly group, it remained nearly unchanged, decreasing slightly from 3.6 ± 0.1 cm to 3.5 ± 0.1 cm.Statistical analysis using t-tests confirmed that the differences in all thoracic parameters between the two age groups at each observation point were statistically significant ($p < 0.05$). These results suggest that while both groups benefited from long-term physical therapy, middle-aged women experienced more pronounced improvements in chest wall dynamics and general thoracic flexibility.The overall pattern indicates that TPE had a sustained effect in preserving thoracic mobility and promoting gradual normalization of chest structure, even three years after mastectomy. The slightly superior outcomes in the middle-aged group may be attributed to better baseline physical condition and a more adaptive musculoskeletal system.

Table 1 - Chest Circumference and Excursion Parameters

Parameter	12 mo (Mid-age)	12 mo (Elderly)	24 mo (Mid-age)	24 mo (Elderly)	36 mo (Mid-age)	36 mo (Elderly)
Chest Circumference (Rest)	90.7 ± 0.7 cm	84.0 ± 0.8 cm	89.9 ± 0.7 cm	83.2 ± 0.8 cm	89.1 ± 0.7 cm	82.2 ± 0.8 cm
Chest Circumference (Inhalation)	96.0 ± 0.6 cm	87.5 ± 0.7 cm	95.2 ± 0.6 cm	86.7 ± 0.7 cm	94.4 ± 0.6 cm	85.7 ± 0.7 cm
Chest Circumference (Exhalation)	90.9 ± 0.6 cm	82.5 ± 0.7 cm	90.1 ± 0.6 cm	81.7 ± 0.7 cm	89.3 ± 0.6 cm	80.7 ± 0.7 cm
Chest Excursion	4.0 ± 0.1 cm	3.6 ± 0.1 cm	3.9 ± 0.1 cm	3.4 ± 0.1 cm	3.8 ± 0.1 cm	3.5 ± 0.1 cm

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Conclusion

The present study demonstrates that therapeutic physical exercise (TPE) has a significant and sustained impact on thoracic parameters in women who have undergone mastectomy, particularly over a long-term rehabilitation period of 36 months. Both middle-aged and elderly women benefited from regular physical therapy, although the degree of improvement varied by age group.Chest circumference at rest in middle-aged women decreased moderately from 90.7 ± 0.7 cm at 12 months to 89.1 ± 0.7 cm at 36 months, while in elderly women it declined from 84.0 ± 0.8 cm to 82.2 ± 0.8 cm. Chest excursion, reflecting respiratory mobility, was better preserved in the middle-aged group, decreasing only from 4.0 ± 0.1 cm to 3.8 ± 0.1 cm, compared to a smaller reduction from 3.6 ± 0.1 cm to 3.5 ± 0.1 cm in elderly women.Statistical analysis confirmed that differences between age groups were significant ($p < 0.05$), particularly in chest circumference during inhalation and exhalation. The Beijing lineage continues to dominate drug-resistant TB populations; however, in this study, structured rehabilitation following mastectomy demonstrated measurable recovery of physical capacity regardless of age.These findings emphasize the necessity of including long-term, age-appropriate physical therapy in standard breast cancer rehabilitation protocols to improve outcomes and quality of life.

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