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ORIGINAL RESEARCH

Physical therapy after breast cancer surgery improves range of motion and pain over time

Fisioterapia após cirurgia de câncer de mama melhora a amplitude de movimento e a dor ao longo do tempo

La fisioterapia después de la cirugía de cáncer de mama mejora el rango del movimiento y el dolor a lo largo del tiempo

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ABSTRACT | Treatment of breast cancer can impair range of motion (ROM) and cause homolateral upper limb pain (UL). This study aimed to compare the ROM, intensity and characterization of UL homolateral pain between the 1st, 10th and 20th sessions of physiotherapy, besides correlating these variables. A clinical trial self-controlled study involving 49 women after mastectomy or quadrantectomy with pain complaint on UL was conducted. ROM was evaluated by goniometry and contralateral UL was adopted as control. The intensity of pain was evaluated by the visual analogue scale (VAS) and characterized by the McGill questionnaire, obtaining the number of words chosen (NWC) and the pain evaluation index (PRI). The ROM of the homolateral UL increased significantly over the 20 sessions. Comparing the homolateral UL with the control, only the abduction did not improve significantly after the 20th session. Pain intensity, PRI and NWC reduced significantly between 1st and 10th and between 1st and 20th sessions. The sensory and evaluative categories also decreased significantly. We observed a significant correlation between VAS, PRI and NWC in the 10th and 20th sessions. Physiotherapy increased ROM, reduced pain in the homolateral UL, and fewer words were chosen to characterize the pain. Significant improvements were observed at the beginning of treatment, but with additional gains over time. Exercises for bilateral flexion, abduction, and external rotation should be emphasized.

Keywords | Breast Neoplasms; Mastectomy; Pain; Physical therapy; Range of Motion, Articular.

RESUMO | O tratamento do câncer de mama pode prejudicar a amplitude de movimento (ADM) e causar dor no membro superior (MS) homolateral. O objetivo deste estudo foi comparar a ADM, a intensidade e a caracterização da dor no MS homolateral à cirurgia entre as 1ª, 10ª e 20ª sessões de fisioterapia, além de correlacionar estas variáveis. Foi conduzido um ensaio clínico autocontrolado com a participação de 49 mulheres após cirurgia de câncer de mama que se queixavam de dor no MS. A ADM foi avaliada por meio de goniometria e o MS contralateral foi adotado como controle. A intensidade de dor foi avaliada pela escala visual analógica (EVA) e caracterizada pelo Questionário de McGill, obtendo-se o número de palavras escolhidas (NWC) e o índice de avaliação da dor (PRI). Verificou-se aumento significativo da ADM do MS homolateral ao longo das 20 sessões. Comparando o MS homolateral ao contralateral, somente a abdução não melhorou significativamente após a 20ª sessão. Observou-se uma redução significativa da intensidade de dor, do PRI e do NWC entre a 1ª e 10ª e entre a 1ª e 20ª sessão. As categorias sensorial e avaliativa também diminuíram significativamente. Foi encontrada uma correlação significativa entre EVA, PRI e NWC entre a 10ª e a 20ª sessão. A fisioterapia aumentou a ADM,

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reduziu a dor no MS homolateral e o número de palavras escolhidas para caracterizar a dor. Foram observadas melhoras expressivas no início do tratamento e ganhos adicionais ao longo do tempo. Exercícios para flexão, abdução e rotação externa bilaterais devem ser enfatizados no tratamento.
Descritores | Neoplasias da Mama; Mastectomia; Dor; Fisioterapia; Amplitude de Movimento Articular.

RESUMEN | El tratamiento del cáncer de mama puede afectar al rango del movimiento (RDM) y causar dolor en el miembro superior (MS) ipsilateral. El objetivo de este estudio fue comparar el RDM, la intensidad y la caracterización del dolor en el MS ipsilateral después de la cirugía entre la 1.ª, la 10.ª y la 20.ª sesión de fisioterapia, además de correlacionar estas variables. Se realizó un ensayo clínico autocontrolado con la participación de 49 mujeres después de haber sometido a cirugía de cáncer de mama y que se quejaban de dolor en el MS. El RDM se evaluó mediante goniometría, y se adoptó como control el MS contralateral. La intensidad del dolor se evaluó mediante la escala analógica visual (EVA) y se caracterizó mediante el Cuestionario de McGill, que obtuvo el número de palabras elegidas (NWC) y el índice de evaluación del dolor (PRI). Hubo un incremento significativo en el RDM del MS ipsilateral durante las 20 sesiones. En las comparaciones entre el MS ipsilateral y el contralateral, solo la abducción no mejoró significativamente después de la 20.ª sesión. Hubo una reducción significativa en la intensidad del dolor, del PRI y del NWC entre la 1.ª y la 10.ª sesión y entre la 1.ª y la 20.ª sesión. Las categorías sensoriales y evaluativas también disminuyeron significativamente. Se encontró una correlación significativa entre EVA, PRI y NWC entre la 10.ª y la 20.ª sesión. La fisioterapia pudo incrementar el RDM, reducir el dolor del MS ipsilateral y disminuir la cantidad de palabras elegidas para caracterizar el dolor. Se encontraron mejoras significativas al comienzo del tratamiento y ganancias adicionales a lo largo del tiempo. Los ejercicios bilaterales de flexión, abducción y rotación externa deben enfatizarse en el tratamiento.
Descriptores | Neoplasias de la Mama; Mastectomía; Dolor; Fisioterapia; Rango del Movimiento Articular.

INTRODUCTION

Breast cancer is the most frequent type of cancer among women, and the second most common cause of deaths in Brazil[1]. Early diagnosis and advances in treatment allow for a longer survival, but women are still subject to side effects[1]. Surgical procedures, especially mastectomy associated with axillary lymph node dissection (ALND), may result in complications such as: scar dehiscence and adhesion, seroma, shoulder range of motion (ROM) restriction, joint stiffness, muscle weakness, shoulder or upper limb (UL) pain, altered sensitivity, lymphedema and fatigue[2-13]. One year after surgery, approximately 85% of women have at least one physical morbidity[2].

Shoulder movement limitation and pain are frequent physical-functional complications[2-9] that can cause functional impairment in daily activities, restricting household chores, work activities, hygiene and clothing[2-9]. Complaints such as difficulty in reaching objects above shoulder height, buttoning the bra and combing or drying the hair represent impairments in functionality, which affect quality of life (QoL)[8-11].

Many women lead an active lifestyle and play key roles in family, professional and social life. Thus, the performance of therapeutic exercises in the postoperative period is indispensable for the promotion and recovery of health, aiming at the resumption of women's activities[10,12]. The practice of these exercises is safe to recover the function and ROM of the UL, and does not increase the possible complications[14-16]. Several studies demonstrate that exercises can be started as soon as possible, they can be active with free amplitude, respecting the limit of each patient and emphasizing flexion, abduction and external rotation and strengthening exercises[11,14-16].

Since pain and restriction of ROM are the main complaints, this study aims to compare ROM, intensity and characterization of pain in homolateral UL over a kinesiotherapy exercise program, and to correlate these variables.

METHODOLOGY

Study design

This is a self-controlled clinical trial (pre- and post-intervention) conducted in the Physiotherapy Sector of OncoRadium, in the municipality of Aracaju, Sergipe. All volunteers signed an informed consent form.

Participants

The convenience sample consisted of women referred to physical therapy who met the eligibility criteria.

The inclusion criteria were: having undergone mastectomy or unilateral quadrantectomy associated with axillary lymph node dissection; and complaining of shoulder pain, in the anteromedial region of the arm and/or in the lateral chest wall in the UL homolateral to the surgery.

Exclusion criteria were: pain or orthopedic/rheumatological diseases in the upper limbs prior to surgery, lymphedema (difference greater than two centimeters between the limbs), breast reconstruction, abandonment of treatment, death and lack of understanding of questionnaires.

Evaluation

An anamnesis was performed to describe personal and clinical data. The physical examination was conducted before the 1st and after the 10th and 20th sessions, by a single examiner with a one-year experience. The participants had one or two days on average to rest between the evaluations and the consultations.

Range of Motion (ROM)

To measure the ROM of flexion (FL), abduction (ABD) and external rotation (ER) of the homolateral UL and contralateral UL (control), a CARCI® goniometer was used, while the woman performed the active free movement of shoulder with the posture properly aligned. The movements of FL and ABD were measured in orthostasis and ER, in dorsal decubitus. Each joint measure was repeated three times and the mean of these measures was adopted as the final value.

Intensity and characterization of pain

Pain intensity in the UL homolateral to surgery was assessed by the visual analogue scale (VAS). The *McGill Pain Questionnaire* (MPQ) was used to characterize pain since it measures the multidimensional aspects of pain[17]. The MPQ consists of 78 words distributed in the sensory, affective, evaluative and mixed or miscellaneous categories. The number of words chosen (NWC) and pain rating index (PRI) were obtained from the MPQ.

Intervention

Twenty individualized consultations were performed (60 minutes, every other day, three times a week) involving passive glenohumeral and scapulothoracic mobilization (3×60"); cicatricial mobilization; passive stretching of the cervical musculature and upper limbs (1×30 to 60"); pendulum exercises; and shoulder active free exercises isolated or combined for flexion/extension/abduction/adduction/medial and lateral rotation and resisted, with the aid of elastic bands and dumbbells of 0.5 to 1.0kg (three sets of 8 to 12 repetitions). The exercises were supervised and all participants received verbal and written guidance regarding limb and skin care[8].

An independent researcher developed the physiotherapeutic protocol.

Statistical analysis

The data were analyzed using the BioEstat 5.0 software. The Shapiro-Wilk test was applied and the normal distribution of the data was verified. Measures of central tendency (mean), dispersion (standard deviation), frequency and percentage were used to characterize the sample. Analysis of variance (ANOVA) was applied for repeated measures, followed by Tukey's *post hoc* test. For comparison of independent measures, Student's *t*-test was used, and for simple linear correlation, Pearson's correlation was used. A significance level of $p<0.05$ was adopted in all analyses.

RESULTS

Of the 64 women selected, 49 completed the study (Figure 1). The mean age was 50.61±11.14 years and BMI was 27.01±5.43kg/m². Of the participants, 27 (55.1%) were married and 17 (34.6%) engaged in domestic activities. Forty (81.6%) women underwent modified radical mastectomy and nine (18.4%) quadrantectomy, predominantly on the left side. Averaged 16.4±5.9 axillary lymph nodes were removed, of which 2.92±1.65 were compromised. Regarding adjuvant treatments, 29 (59.1%) underwent chemotherapy (CTX) and 23 (46.9%) underwent radiotherapy (RT). The beginning of physical therapy occurred between 4 and 8 weeks postoperatively.

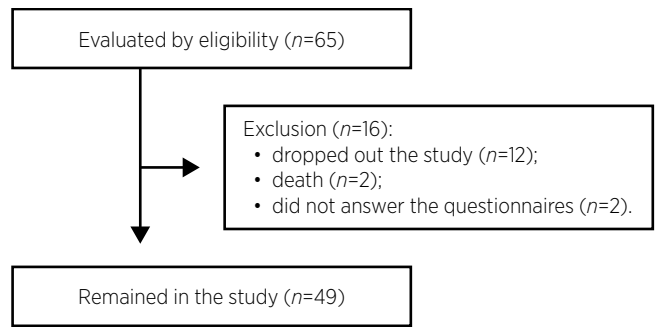

Figure 1. Women's selection flowchart

In the first session, the ROM of FL, ABD and homolateral ER were significantly lower when compared with the contralateral UL (control). After the 10th and until the 20th session, all movements of the homolateral shoulder increased significantly. Although ROM increased significantly throughout treatment, ABD remained significantly lower, both in the 1st (p<0.01) and 20th sessions (p=0.03) compared to control UL (Table 1).

In Figure 2, VAS, PRI and NWC decreased significantly from the 1st to the 10th and from the 1st to the 20th session, which was not observed between the 10th and 20th session. The scores of McGill's sensory and evaluative categories decreased significantly between the 1st and 10th and between the 1st and 20th sessions. However, for the scores of the affective and mixed categories, no significant difference was found.

The scores of the sensory and evaluative categories decreased significantly between the 1st and 10th, and between the 1st and 20th session, but this did not occur between the 10th and 20th session. The affective and mixed categories decreased over time, but without significant difference (Table 2).

Table 1. Comparison of range of motion over the course of treatment and of the homolateral upper limb with the control (n=49)

ROM	1st session	10th session	20th session	Control	p1	p2
Flexion	114.95±31.60	142.97±23.98[a]	150.83±23.46[b,c]	158.51±18.93	<0.01	0.77
Abduction	115.32±29.15	139.38±23.90[a]	147.24±25.11[b,c]	160.22±17.52	<0.01	0.03
External rotation	63.04±21.04	71.81±18.85[a]	75.48±16.57[b,c]	80.95±14.08	0.01	0.08

Values in mean±standard deviation; ANOVA for repeated measures, followed by Tukey's *post hoc* test (p<0.05), in which: a: 1st×10th session; b: 1st×20th session; c: 10th×20th session. Student's *t*-test (p<0.05), where p1: UL control × homolateral UL in the first session; p2: UL control × homolateral UL in the 20th session.

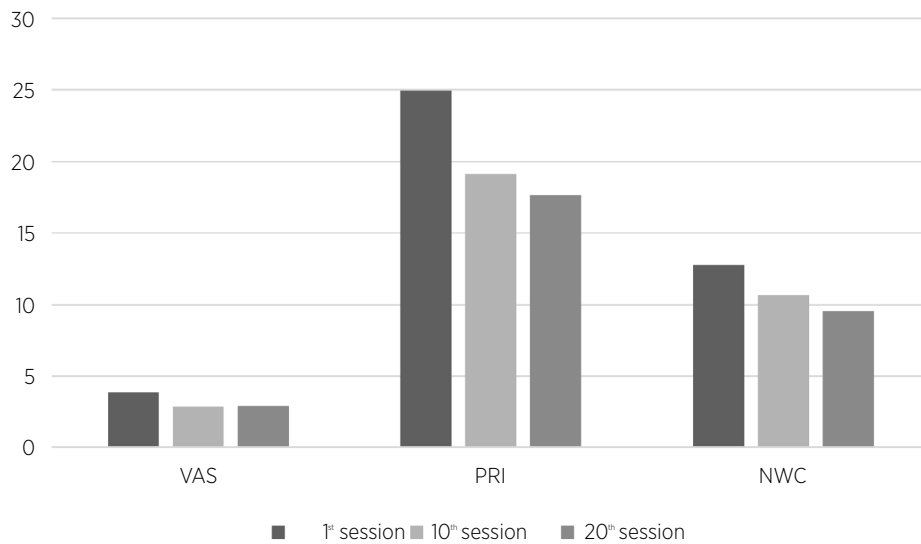

Figure 2. Comparison of pain intensity, pain assessment index and number of words chosen, (n=49)
p<0.05 between the 1st and 10th session; and p<0.05 between the 1st and 20th session in all variables. ANOVA for repeated measures, followed by Tukey's *post hoc* test.

Table 2. McGill category scores throughout treatment (n=49)

Categories	1st session	10th session	20th session	p
Sensory	14.85±5.91	11.53±6.40[a]	10.55±7.30b	0.004
Affective	4.75±3.93	3.81±3.82	3.63±3.11	0.271
Evaluative	1st1.97±1.26	1.51±1.00[a]	1.32±1.14[b]	0.015
Mixed	3.30±2.46	2.59±2.63	2.18±2.62	0.094

Values in mean±standard deviation; ANOVA followed by Tukey's *post hoc* test: a: 1st×10th session; b: 1st×20th session.

We observed a moderate, positive and significant correlation between VAS and PRI and NWC, both in the 10th and 20th sessions. This indicates that the lower the pain, the lower the pain index and the lower the number of words chosen (Table 3). No correlation was found between ROM and VAS at any of the evaluated moments.

Table 3. Linear correlation of the visual analogue scale with pain index and number of words chosen throughout the treatment (n=49)

Visual Analogue Scale (VAS)						
	1st session		10th session		20th session	
PRI	r=0.162	p=0.264	r=0.556	p<0.001	r=0.560	p<0.001
NWC	r=0.122	p=0.400	r=0.560	p<0.001	r=0.558	p<0.001

r: Pearson correlation.

DISCUSSION

Physiotherapy in the postoperative period of mastectomy or unilateral quadrantectomy associated with axillary lymph node dissection allowed significant improvement in shoulder ROM and reduction of pain in the homolateral upper limb after surgery. Physiotherapy plays an important role in the prevention, early detection and treatment of complications in the postoperative period of breast cancer[11]. Studies on this subject are generally based on exercises and focused on shoulder mobility[16].

Flexion, abduction and external rotation are the most compromised movements in the immediate postoperative period of breast cancer and are very important for performing activities of daily living (ADLs). We observed a significant increase in ROM of these movements at the beginning of treatment and additional gains between the 10th and 20th sessions. Such findings are expected and corroborate the literature[8,10,18].

It is noteworthy that, at the end of 20 sessions, the homolateral ROM was functional, but the abduction remained lower when compared with the control UL. Other studies have found similar results[3,9,13] and found that a limitation of shoulder movement of less than 30°, both in shoulder flexion and abduction, may be compatible with the daily and basic tasks to be performed by a woman, such as combing her hair and buttoning her bra[8].

Pain intensity decreased significantly in the 10th session, remaining stable in the final evaluation. Despite the decrease, the mean found in this study represents mild to moderate pain and, clinically, it may not represent a considerable change in pain. Similar results were found in the clinical trial by Beurskens et al.[19], in which they evaluated shoulder pain and ROM of 30 women after surgery and axillary dissection. At the end of three and six months, the group that underwent standardized physical therapy and arm exercises counseling showed significant improvement in ROM and pain, when compared with the control group that received only advice on exercises. Recently, De Almeida-Rizzi et al.[14] evaluated the effect of exercises on the ROM of women after breast reconstruction and found no difference in postoperative complications. Moreover, the researchers observed that, although present in all evaluations, the complaint of moderate to severe pain reduced after the last session.

Throughout the 20 sessions, women chose a smaller number of words to characterize and describe pain, and the scores of the four categories decreased during treatment, especially the sensory and the evaluative. The sensory category has the main criteria to describe neuropathic pain, besides presenting 53.8% of the descriptors of the entire questionnaire, due to its disproportionate distribution. Thus, we suppose that the evaluated person is induced to choose more sensory descriptors, as observed. The affective category decreased over time, but not significantly, since the affective component characterizes pain of neoplastic origin. In addition to the variables evaluated, new discussions have considered the role of angiogenesis in the development of UL pain and dysfunction[20].

We found a correlation between VAS and PRI and NWC in the 10th and 20th sessions, indicating that the lower the pain intensity, the lower the number of words chosen. Clinically, a correlation is expected and meets the positive effects of the therapy used. No correlation was found between ROM and VAS, perhaps due to the type of variable studied or the sample size.

In the literature, there is still no consensus regarding the length of follow-up, as well as the type of follow-up and physiotherapeutic resources. However, it is a consensus that the sooner the intervention begins with targeted and bilateral exercises[13], the better the therapeutic response[12,14-16].

In Brazil, women users of public services find different realities, such as late referral, services that only offer guidance or a short follow-up period. In private services, they can have from a limited number of supervised physiotherapy to the access to follow-up for a longer period. Therefore, physiotherapists must be alert and offer a good care during the period available for the care of these women. They should be guided and motivated to perform exercises for the UL, monitored by a specialized professional and have more follow-up time.

These exercises should be emphasized bilaterally, respecting the biomechanics of the shoulder girdle.

Since, in Brazil, it is estimated that there are 61.61 new cases per 100,000 women[1] and that many women will undergo surgery and complementary treatments, the findings of this study are relevant, as the functional recovery of the UL contributes to social, family and labor reintegration, besides providing more autonomy and a more active lifestyle.

Study limitations

We could not include a control group, but the contralateral UL was adopted as a control measure for comparison of ROM. We stress the importance of including questionnaires on functionality and quality of life in the study.

CONCLUSION

Physiotherapy contributed to the improvement of ROM and to the reduction of pain intensity in the homolateral upper limbs. Women should increase bilateral exercises of flexion, abduction and external rotation to maintain the results and additional gains.

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