REVIEW

The Efficacy of Exercise Therapy in Reducing Shoulder Pain Related to Breast Cancer: A Systematic Review

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ABSTRACT

Purpose: Recent research indicates that physiotherapy interventions, such as exercise and manual therapy, may be effective in decreasing the frequency of side effects linked with breast cancer treatment, including fatigue, pain, nausea, and decreased quality of life. This systematic review aims to determine the efficacy of exercise therapy in reducing shoulder pain related to breast cancer treatment and to identify outcome measures that can be used to assess shoulder pain in this population. ***Methods:*** A systematic review of the current literature was conducted using portals such as the Physiotherapy Evidence Database (PEDro), the Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, Ovid MEDLINE (1996 to April 2011), and Allied and Complementary Medicine (AMED) (1985 to April 2011). Databases were searched for relevant studies published up to April 2011. Participants in relevant studies were adults ($\geq$18 years of age) with a primary diagnosis of breast cancer at any point during the treatment of their disease. ***Results:*** Six articles were independently appraised by two blinded reviewers. Six studies met the inclusion criteria, each analyzing different types of exercise—shoulder/arm/scapular strengthening/stabilization, postural exercises, general exercises and conditioning, shoulder range-of-motion exercises, and lymphedema exercises—with respect to their efficacy in reducing shoulder pain related to breast cancer treatment. ***Conclusions:*** Results suggest that exercise targeting shoulder pain related to breast cancer treatment may be effective. However, definitive conclusions cannot be drawn due to the lack of methodological quality and homogeneity of the studies included. Clinicians should use valid outcome measures, such as the visual analogue scale and brief pain inventory, to evaluate the effectiveness of this treatment.

Key Words: breast neoplasm; exercise therapy; motor activity; shoulder pain.

RÉSUMÉ

Objectif : Des recherches récentes indiquent que les interventions de physiothérapie comme l'exercice et la thérapie manuelle peuvent être efficaces pour réduire la fréquence des effets secondaires liés au traitement du cancer du sein, y compris la fatigue, la douleur, les nausées et une baisse de la qualité de vie. Cette critique systématique vise à déterminer l'efficacité de la thérapie par l'exercice lorsqu'il s'agit d'atténuer une douleur à l'épaule liée à un traitement du cancer du sein et à déterminer les mesures de résultat qu'il est possible d'utiliser pour évaluer la douleur à l'épaule dans cette population. ***Méthode :*** On a procédé à un examen systématique des publications courantes en utilisant des portails comme PEDro, CINAHL, PubMed, Ovid MEDLINE (1996 à avril 2011) et AMED (1985 à avril 2011). On a cherché dans des bases de données des études pertinentes publiées jusqu'en avril 2011. Les participants aux études pertinentes étaient des adultes ($\geq$18 ans) qui avaient reçu un diagnostic primaire de cancer du sein à n'importe quel moment au cours du traitement de leur maladie. ***Résultats :*** Six articles ont fait l'objet d'examens à l'aveugle effectués par des examinateurs indépendants. Six études ont satisfait aux critères d'inclusion, chacune analysant des types différents d'exercice—renforcement/stabilisation de l'épaule, du bras ou de l'omoplate, exercices posturaux, exercices généraux et conditionnement, exercices portant sur l'amplitude du mouvement de l'épaule et exercices contre le lymphœdème—en ce qui a trait à leur efficacité pour réduire la douleur à l'épaule liée au traitement du cancer du sein. ***Conclusions :*** Les résultats indiquent que les exercices prescrits contre la douleur à l'épaule liée au traitement du cancer du sein peuvent être efficaces. On n'a pu toutefois tirer de conclusions définitives parce que les études incluses manquaient de qualité méthodologique et d'homogénéité. Les cliniciens devraient utiliser des mesures de résultat valables comme l'échelle analogue visuelle et le bref inventaire de la douleur pour évaluer l'efficacité du traitement.

According to the 2011 *Canadian Cancer Statistics,* breast cancer—in which abnormal cells originate in the lobules of the breast or, more commonly, within the ducts[1]—represents 25.6% of new cancer diagnoses in women and is associated with a 14.2% mortality rate.[1] The estimated incidence rate for breast cancer in 2012 is 53 new cases per 100,000 people; 11 of those 53 are expected to die from the disease.[1] Although improvements in breast cancer treatment techniques have led to significant increases in survival rates, long-term physical side

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Box 1 Summary of Inclusion and Exclusion Criteria for Article Selection

Inclusion criteria	Exclusion criteria
Full article accessible online or in print, in any language	Control group also participated in a supervised exercise programme
Research conducted using a primary study design (randomized controlled trial or high-quality case series)	Article was a newspaper editorial, a critical review of individual articles, or a qualitative research study
Participants included adults ($\geq$18 years of age) with a primary diagnosis of breast cancer at any point during treatment of their disease and a report of shoulder/chest pain	
Interventions included any form of exercise or physical activity, used alone or in combination with other forms of treatment	
Outcome measures included a measure of shoulder/chest pain, alone or in combination with other outcomes	

effects associated with surgery, radiation, and chemotherapy continue to be reported.[2] Common complications include restricted shoulder range of motion (ROM), upper limb weakness, lymphedema, pain, and reduced quality of life.[3–7] A recent systematic review reported that surgery and radiation for breast cancer may cause persistent pain in the arm, shoulder, and breast area in 30%–50% of patients, lymphedema in 15%–25% of patients, and restricted shoulder/arm ROM in 35% of patients for 3–5 years after treatment.[2] Another systematic review indicated that the prevalence of shoulder and arm pain is between 9% and 68% and that pain persists in more than 20% of patients at 30 months after surgery.[8]

The causes of shoulder pain related to breast cancer are thought to include muscle tightness, neurogenic pain due to lymph node removal, axillary cording, edema formation, and adhesive capsulitis resulting from restricted shoulder motion.[9] Recent research has indicated that physiotherapy interventions after breast cancer surgery are effective in improving shoulder ROM and function as well as reducing the occurrence of lymphedema and improving quality of life.[9–12] A systematic review of exercise interventions for upper limb dysfunction secondary to breast cancer treatment[12] discussed four articles that included pain as an outcome and found no statistically significant difference between exercise and control groups in pain levels after treatment.[12] The authors concluded that, while exercise can significantly improve shoulder ROM postoperatively in women with breast cancer, questions remain as to the effectiveness of exercise therapy to manage symptoms of pain in this population.[12] Further research is therefore needed to evaluate the effects of exercise on shoulder pain, an important secondary complication for women with breast cancer who have undergone treatment.

The purpose of our systematic review is to determine whether exercise therapy is more effective than no therapy in reducing shoulder pain for women undergoing treatment of breast cancer, as well as to elucidate which exercise type is most effective. A secondary aim is to identify appropriate outcome measures to assess shoulder pain in this population, an important factor to consider in the assessment and monitoring of clients undergoing therapy.

METHODS

Data source location and selection

We searched the Physiotherapy Evidence Database (PEDro), Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, Ovid MEDLINE (1996 to April Week 3, 2011), and Allied and Complementary Medicine (AMED) (1985 to April 2011) databases for relevant studies published up to and including April 2011. Search terms used to search title, keywords, and full text included *exercise*, *exercise therapy*, *cancer* OR *neoplasm*, *breast cancer* OR *breast neoplasm*, *pain*, *shoulder pain*, *pain management*, *physiotherapy*, *physical activity*, and *ROM*. The search strategy was modified for each database and "exploded," when possible, to maximize sensitivity and produce a comprehensive search. The initial search retrieved 13 articles, which we short-listed by analyzing title, abstract, and subject heading. Three authors (JG, JT, and LV) independently reviewed the studies to determine whether they met the inclusion criteria (see Box 1).

After the initial search, we reviewed the reference lists of the articles retrieved to ensure that all pertinent studies were included; we found one additional applicable article in this manner. A fourth author (KS) translated one article published in French, and an outside source translated an article written in Chinese to help us determine whether or not these studies met our inclusion criteria. At this point, the study by Le Vu and colleagues[13] was deemed appropriate for inclusion, while the study by Cheng and colleagues[14] was not. Thus, following the literature search, six articles matched our inclusion criteria. Hard copies of all six articles were retrieved and read in full. See Figure 1 for a graphic representation of the selection process.

Data extraction and synthesis

The studies were then blinded and given to two independent reviewers (KS and BT) for critical appraisal using

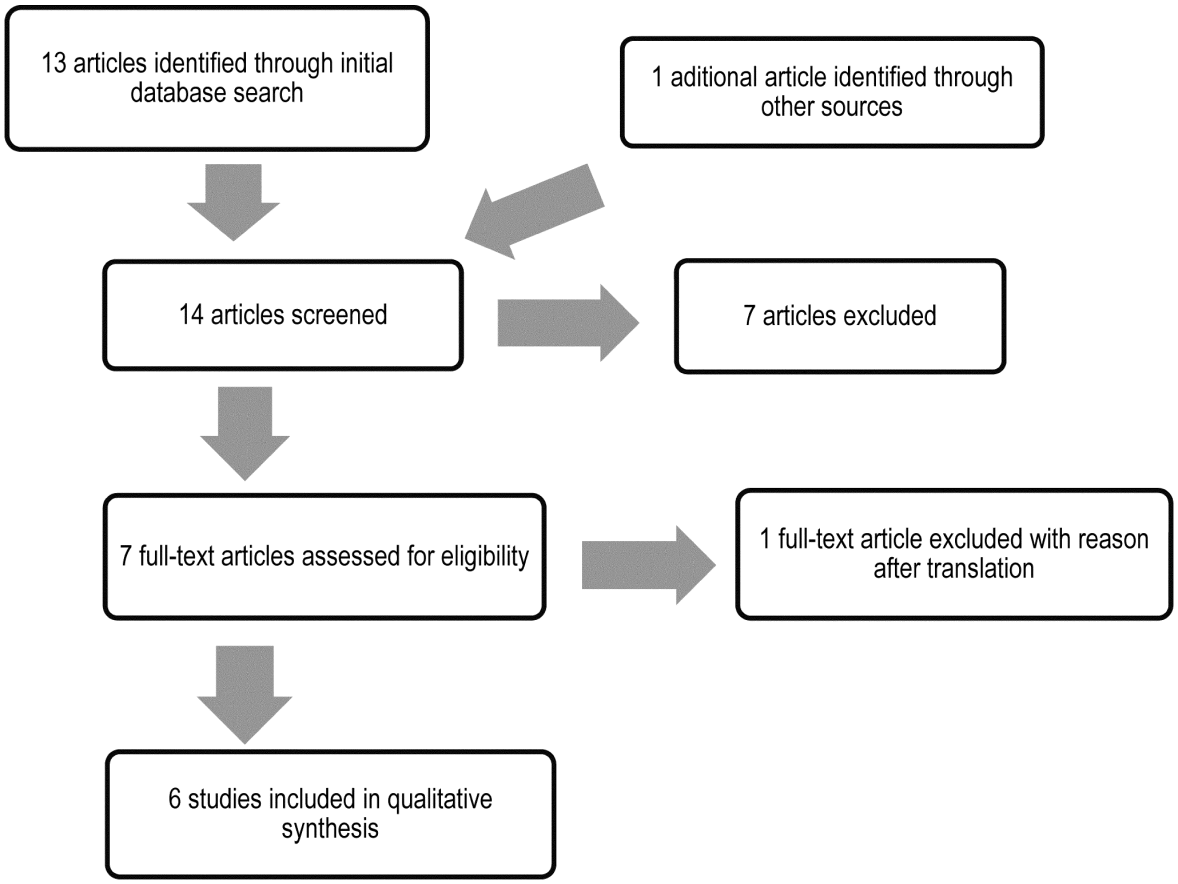

Figure 1 Graphic representation of selection process for included articles.

the PEDro scale. The 11-item PEDro scale was developed to rate the methodological quality of trials relevant to physiotherapy practice and aims to give users a quick indication of a study's design features.[15,16] The scale considers two aspects of a study's quality: internal validity and external validity.[16] A quality score ranging from zero to ten is determined based on the number of individual criteria that the trial satisfies. A PEDro score of 9–10 is considered to indicate "excellent quality"; a score of 6–8, "good quality"; a score of 4–5, "fair quality"; and a score of <4, "poor quality".[17] The PEDro scale has been found to be highly reliable for evaluating randomized controlled trials (RCTs).[16] Although it is not appropriate for evaluating systematic reviews or clinical practice guidelines, PEDro has been used to evaluate other primary clinical trial designs, such as case studies[16]; however, total scores are lower because these designs lack participant randomization.[16]

Each reviewer received and reviewed a total of six articles (four RCTs and two case series). Inter-rater reliability of the PEDro scores was calculated using percentage agreement of the raters' evaluations of two articles[18,19] and by comparing their results with those of two experts (OC and JS). For the two articles assessed, there was raw agreement of 90.9% between the two raters ($\kappa = 0.74$, $p < 0.05$) and expert evaluators ($\kappa = 0.74$–1, $p < 0.05$). Disagreements among reviewers were resolved through discussion.

Data was extracted and sorted from each article on the types of exercises implemented and their effect on shoulder pain in patients with breast cancer. Data analysis to determine p values and effect sizes was subsequently completed to synthesize results and draw conclusions on the efficacy of each exercise type, taking into account outcome measures, methodology, and quality of the studies.

RESULTS

Using the PEDro scale, we determined that three studies were of good methodological quality, one of fair quality, and two of low quality (see Table 1).[13,19–22] We were not able to perform a meta-analysis because of the heterogeneity of the exercise types included in each study's exercise regime and the timing of these exercise regimes in relation to cancer treatment (see Table 2 for specific details of the included studies). This section summarizes each study's findings, discussing types of exercises used and their association with outcome measures of pain.

Table 1 Summary of PEDro Scales and Methodological Quality for All Included Studies

Study (date)	PEDro score, /10*	Quality[17]	Random allocation	Concealed allocation	Groups similar	Participant blinding	Therapist blinding	Assessor blinding	<15% dropouts	Intention to treat	Between-group comparison	Variability Data
Beurskens et al. (2007)[18]	8	Good	Y	Y	Y	N	N	Y	Y	Y	Y	Y
Herrera & Stubblefield (2004)[21]	2	Poor	N	N	N	N	N	N	Y	N	N	Y
Hwang et al. (2008)[20]	5	Fair	Y	N	Y	N	N	N	Y	N	Y	Y
Lee et al. (2010)[19]	6	Good	Y	N	Y	N	N	Y	N	Y	Y	Y
Le Vu et al. (2007)[13]	6	Good	Y	N	Y	N	N	Y	Y	Y	Y	N

* The PEDro (Physiotherapy Evidence Database) scale is an 11-item scale developed to evaluate the quality of randomized controlled trials in research pertaining to physiotherapy practice.

Beurskens and colleagues[18] conducted an RCT to assess the efficacy of physiotherapy following breast cancer and axillary node dissection. The exercise programme for the treatment group included advice on exercises for both arm and shoulder. Treatment also included postural correction, upper extremity coordination exercise, general strengthening and conditioning exercise, and exercise for lymphedema. The programme took place in nine sessions over 3 months. One of the main outcome measures was the visual analogue scale (VAS); the results showed that shoulder/arm pain was significantly improved after physiotherapy treatment, with VAS scores decreasing by 3.4 points in the treatment group and 0.5 points in the control group ($p < 0.001$).[18]

In another RCT, Lee and colleagues[19] focused on the effects of scapular-oriented exercises on shoulder dysfunction in breast cancer survivors. This study compared a group receiving scapular-oriented exercises and a group receiving general exercises to a historical control group without exercise. Scapular-oriented exercises included stretching and resistance training of shoulder muscle groups; both intervention groups also received a general exercise programme that included ROM exercises and full-body conditioning. The results, as measured by the Brief Pain Inventory (BPI), demonstrated that the scapular-oriented exercise group had significant improvements in pain ($p = 0.007$) compared to the historical control group.[19] However, differences between the two exercise groups (scapular-oriented and general exercises) were not found to be significant.[19]

Le Vu and colleagues[13] conducted an RCT comparing the efficacy of shoulder mobilization exercises, massage, or a combination of the two in reducing shoulder pain after breast cancer surgery. Based on a self-report of pain or no pain, the frequency of pain did not differ between groups either at postoperative day 7 or at the 3-month follow-up.[13] At 8–24 months after surgery, however, the two groups who received shoulder exercises, either alone or in combination with massage, reported significantly less shoulder pain than groups receiving treatment without shoulder mobilizations (i.e., the ''massage only'' and ''no intervention'' groups; 5% vs. 13%, $p = 0.030$).[13]

Another RCT by Hwang and colleagues[20] discussed the effects of a supervised moderate-intensity exercise programme in reducing pain and other side effects of radiotherapy treatment of adults with breast cancer. In their study, 40 adults were randomized to a supervised exercise programme or a control group of self-stretching. The treatment group included exercise for shoulder strengthening and stretching and general aerobic exercise. Hwang and colleagues found that pain scores decreased in the exercise group (measured by VAS) and increased in the control group[20]; their results were statistically significant ($p < 0.05$).[20]

Using a retrospective case series design, Herrera and Stubblefield[21] followed a group of eight breast cancer

Table 2 Data from Studies Included in the Final Review

Study (date), type	Sample size, details, purpose	Inclusion/exclusion	Follow-up	Intervention	Comparison/control	Key outcomes	Results	Conclusions
Beurskens et al. (2007),[18] RCT	$n = 30$ Mean age: 55 (SD 11, range 34–82) y *Purpose:* assess efficacy of PT following BrCa and ALND	Included: Adults ($\geq$18 y) with BrCa having to undergo ALND VAS pain score $\geq$1 Moderate shoulder disability in daily life (3/5 on disability score list) Excluded: Previous contralateral BrCa surgery Insufficient knowledge of Dutch language	2 wk after surgery 3 mo after completion of PT 6 mo from baseline	PT initiated 2 wk after surgery Advice for arm/shoulder exercises Posture correction Coordination exercises Exercises for strength and general physical condition Exercises to prevent lymphedema Soft-tissue massage for surgical scar 9 treatments in 3 mo Home exercises for 10 min/d	Leaflet with advice and exercises; no further contact with PT	Shoulder/arm pain (VAS) Shoulder mobility flexion/abduction (digital inclinometer) DASH Edema (water displacement) Grip strength (dynamometer) QOL (SIP)	All patients completed the trial Functional shoulder impairments and pain significantly decreased after PT Rx ($p < 0.001$) Pain (VAS) decreased by 3.4 points ($p < 0.001$, ES $= -2.7$) in Rx group and 0.5 points in control group	PT can reduce pain, improve shoulder function, and improve QOL after ALND
Herrera & Stubblefield (2004),[21] Retrospective case series	$n = 8$ Mean age 58 y (range 49–81) *Purpose:* determine the efficacy of Rx for rotator cuff tendinitis and lymphedema after BrCa surgery	Included: Adults with lymphedema, ipsilateral shoulder pain Dx of rotator cuff tendinitis (Hawkin's test, Empty Can test, Neer's Test) Excluded: Active infection Recent shoulder surgery	Baseline and 4–6 wk	NSAIDs PT: strengthening of humeral head stabilizers, scapular stabilizers and supraspinatus muscle (goal: relieve pain, improve function, alter course of RC tendinitis)	N/A	VAS: pain	Mean duration of shoulder pain was 14.2 mo Mean onset of shoulder pain was 4.7 mo after presentation of lymphedema At follow-up, 7/8 patients reported marked decrease in pain (initial mean 8.28, follow-up mean 3.71; mean improvement in pain was 4 VAS points) Effect sizes could not be calculated	It is important to diagnose shoulder pathologies causing pain in people with BrCa Treatment should consist of NSAIDs, shoulder stabilization exercise, and careful monitoring
Hwang et al. (2008),[20] RCT	$n = 40$ Mean age 46.3 (SD 9.5) y *Purpose:* determine whether moderate-intensity exercise can decrease side effects of radiotherapy for people with BrCa	Included: Adults with BrCa who had undergone some sort of surgery for BrCa and were undergoing radiotherapy treatment Excluded: Concurrent major health problems that could affect an exercise programme (hypertension, heart disease, respiratory disease, cognitive dysfunction)	Baseline and completion of radiotherapy	PT: supervised exercise programme 50 min $3\times$/wk for 5 wk (10 min warm-up, 30 min exercise, 10 min cool-down) Exercise included shoulder stretching, aerobic exercise, and shoulder strengthening Exercised at target HR of 50%–70% age-adjusted HRmax	Shown how to perform shoulder ROM exercises and encouraged to perform at home; no supervised exercise programme	QOL (WHOQOL) BFI Shoulder ROM Pain (VAS 0–100)	37/40 participants completed trial Mean VAS score decreased in exercise group and increased in control group ($p < 0.05$) ESs could not be calculated	Positive physical and psychological benefits occur following supervised moderate-intensity exercise during radiotherapy for BrCa No negative effects are evident Exercise should be a part of rehabilitation during radiotherapy

Table 2 *Continued*

Study (date), type	Sample size, details, purpose	Inclusion/exclusion	Follow-up	Intervention	Comparison/control	Key outcomes	Results	Conclusions
Le Vu et al. (2007),[13] RCT	$n = 257$ Mean age 55 y *Purpose:* compare efficacy of shoulder mobilization (exercise), massage, or a combination of both interventions after BrCa surgery	Included: Adults who underwent BrCa surgery (with axillary dissection) between October 1990 and November 1991 Excluded: Previous BrCa treatment (surgery, chemo, radiation) Bilateral BrCa, non-francophones, and those with psychological issues	7 d, 3 mo, and 8–24 mo post-op.	Interventions began on post-op day 1 with random assignment to one of four groups: 1. Shoulder mobilization exercises: active, passive, antepulsion, abduction, rotation ROM 2. Massage of arm/shoulder and scapular region 3. Both exercise and massage 4. No therapy	No intervention	Volume of lymph drained Shoulder ROM Adhesions and cording in axillary region; pain; sensation (self-report questionnaire)	At 7 d and 3 mo post-op, frequency of cording, pain, and sensation trouble did not differ between groups At long-term follow-up (8–24 mo post-op), the exercise alone and massage + exercise groups had significantly less local and regional shoulder pain than control groups (5% vs. 13%, $p = 0.030$) ESs could not be calculated with data provided	In the long term, shoulder mobilization/exercise decreases shoulder pain after BrCa surgery
Lee et al. (2010),[19] RCT	$n = 50$ (16 in each exercise group, 18 in historical control group) Mean age 47 y (range 30–67) *Purpose:* examine the effects of scapula-oriented exercise on upper-limb dysfunction	Included: Adults ($\geq$18 y) with BrCa who followed up at rehab clinic Unilateral BrCa surgery, with adjuvant chemo or adjuvant radiation Excluded: Bilateral or recurrent BrCa Previous BrCa Uncontrolled HTN or cardiac illness Needed additional therapy for LE Pain rated >5 on VAS BDI score >20 (moderate depression) DASH score >50	Baseline, 1 wk post-treatment and 4 wk post-treatment	Random assignment SOE or general exercise group SOE programme: progressive stretching and resistance training of shoulder muscle groups—restoration of normal kinetics General exercise programme (ROM exercises and regular body conditioning) Both groups: Gym 1 × /wk 40 min training sessions of stretching and strengthening 5 min warm-up, 5 min cool-down Given written form of exercises and encouraged to perform exercises between sessions	Historical data matched for age and surgery type No exercise counselling or behavioural change advice provided Leaflet including general shoulder ROM	VAS BPI DASH BDI EORTC QLQ-C30 Goniometer Shoulder ROM Biodex Isokinetic machine—shoulder strength	SOE group showed improvements in pain ($p = 0.007$, ES = 0.269), physical function ($p = 0.027$, ES = −0.4128), social function ($p = 0.043$, ES = −0.334), global QOL ($p = 0.07$, ES = 0.33), and ER strength ($p = 0.001$, ES = 0.55) General exercise group showed improvements in fatigue and ROM: shoulder abduction ($p = 0.041$, ES = −0.141), internal rotation ($p = 0.026$, ES = −0.389), horizontal abduction ($p = 0.027$, ES = 0.402)	SOE has beneficial effects on pain, QOL, and some aspects of strength

Table 2 *Continued*

Study (date), type	Sample size, details, purpose	Inclusion/exclusion	Follow-up	Intervention	Comparison/control	Key outcomes	Results	Conclusions
Morimoto et al. (2003),[22] Case series	$n = 79$ Mean age 50.4 (SD 9.8) y *Purpose:* assess efficacy of post-op rehab	Included: Adults who had undergone surgery for stage 1 or 2 BrCa with no systemic complications and had normal shoulder ROM before surgery	Post-op wk 1, 2, 4, and 12	Leaflet and video used to explain orientation to patients Instructed to exercise 3–4 × /d post-op	N/A	ROM: Goniometry Pain: oral questioning ADL: ability to sleep on affected side, ability to tie an apron, and ability to air futon in the sun—evaluated by *able*, *barely able*, and *unable*	Post op movement-associated pain: • post op wk 1: reported by 64% of pts • post op wk 4: reported by 49% of pts • post op wk 12: reported by 44% of pts no significant difference in pain between operative procedures Effect sizes could not be calculated with data provided	Rehabilitation is effective in decreasing BrCa -related shoulder pain and achieving functional recovery after surgery

RCT = randomized control trial; PT = physiotherapy; BrCa = breast cancer; ALND = axillary lymph node dissection; VAS = visual analogue scale for pain; DASH = Disabilities of the Arm, Shoulder, and Hand Questionnaire; QOL = quality of life; SIP = Sickness Impact Profile; Rx = treatment; ES = effect size; Dx = diagnosis; NSAIDs = non-steroidal anti-inflammatory medications; RC = rotator cuff; HR = heart rate; ROM = range of motion; WHOQOL = World Health Organization Quality of Life; BFI = Brief Fatigue Inventory; HTN = hypertension; LE = lymphedema; BDI = Beck Depression Inventory; SOE = scapula oriented exercises; EORTC QLQ-C30 = European Organization for Research and Treatment of Cancer Questionnaire; ER = external rotation; pts = patients.

survivors with rotator cuff tendinitis. Participants participated in a shoulder strengthening and stability programme as well as taking non-steroidal anti-inflammatory medications (NSAIDs). Using VAS as the primary outcome measure, the authors found that seven out of eight patients reported a marked decrease in shoulder pain, averaging 4 VAS points, following combined NSAIDs and physiotherapy.[21] The results, however, were not presented in terms of statistical significance.

Finally, although pain was not a primary outcome measure of their case series study, Morimoto and colleagues[22] found that their programme emphasizing ROM, strength, and stability for the arm and shoulder was effective at decreasing pain in patients with breast cancer following surgery.[22] Their study assessed pain using four oral questions; prevalence of pain among patients decreased by 20% between weeks 1–4 postoperatively.[22]

DISCUSSION

Adults with breast cancer go through a variety of treatment regimens including surgery, chemotherapy, and radiation therapy. The results of the six studies included in this review indicate that exercise may be beneficial in reducing shoulder pain related to these forms of breast cancer treatment. This is an important question to address because physiotherapy can be a primary treatment method to address common side effects of breast cancer treatment, including lymphedema and decreased ROM (as previous studies have demonstrated), as well as pain. Two of the included studies did not use a standardized measure of pain, relying instead on oral self-reports of participants' shoulder pain.[13,21] We do not know whether participants were asked to grade their pain level or whether they were simply asked about the presence or absence of pain (a yes/no answer). The results of these two studies should be therefore interpreted with caution.

Four of the six studies quantified the severity of shoulder pain using the VAS, which has been shown to be both valid and reliable in assessing pain in people with cancer.[22,23] The VAS is a 10 cm line anchored at the left end with "I have no pain" and at the right with "My pain is as bad as I can imagine"[22]; patients are asked to place a slash along the line indicating their pain intensity.[22] In this population, the VAS has a test-retest reliability of 0.71–0.99 and convergent validity ranging from 0.30 to 0.95 when correlated with the Numeric Pain Rating Scale and the McGill Pain Questionnaire.[22] A change of 1 cm or 1 point on the VAS represents "minimal" or "little" clinically important change, whereas a difference of 2–2.7 points represents "much" or "some" change.[23] Reductions of 50% on the VAS indicate substantial change.[24] Three of the four studies that used the VAS reported specific numbers; two studies demonstrated substantial change, one study did not find a significant difference between intervention and control groups, and one study demonstrated minimal change.[18–21]

Lee and colleagues[19] also measured pain using the BPI, which evaluates both the intensity of pain and the degree to which it interferes with a person's life.[19] An 11-point numeric rating scale (0 = no pain, 10 = pain as bad as you can imagine) is used to measure pain intensity[19]; life interference is measured using a seven-question evaluation with the same 0–10 response scale.[19] Unfortunately, Lee and colleagues do not describe the validity or reliability of this measure. The BPI's psychometric sufficiency was originally established in people with cancer,[24, 25] and its reliability is very high for medical ($r = 0.95$) and surgical ($r = 0.97$) oncology groups.[26] A change of 2 points in the downwards direction represents "much better" or "much improved" pain, and a change of 4 points indicates "very much improved" pain. In the Lee and colleagues[19] study, pain interference scores were very much improved in the scapular stability exercise group; however, this level of change was also observed in the control group.

Both the BPI and the VAS seem to be effective in evaluating patients with shoulder pain related to breast cancer and monitoring the initial and long-term effects of treatment plans. The BPI may be more effective than the VAS in that it also gathers information on how pain affects daily functioning.

Clinical implications

There is currently a lack of up-to-date evidence on the efficacy of exercise therapy in reducing shoulder pain related to breast cancer. A very limited number of studies examining this topic have been published; moreover, these studies are widely heterogeneous with respect to exercise type and treatment timelines. The poor methodological quality of the included studies significantly limits the inferences we are able to draw from our review. However, despite these limitations, the included studies indicate that exercise may be beneficial in reducing shoulder pain related to breast cancer.

LIMITATIONS

Limitations of this systematic review include the low number of articles that met the inclusion criteria, which signals a need for more RCTs on this topic. In addition, two of the six studies included in this review were of low quality, being case series studies. We were not able to perform a meta-analysis because of variability in the chosen interventions, outcome measures used, and timing of measured outcomes.

Strengths of this review include the sound methodology, which follows guidelines outlined in the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) statement,[27] a 27-item checklist that aids authors in reporting findings in systematic reviews and meta-analyses.[27]

Population studied

Five of the six studies in the systematic review recruited participants from one location, increasing the risk of recruitment bias.[13,19–22] Participants in the studies

ranged in age from 30 to 82; the mean age of the participants in all studies was between 50 and 58.[13,18–22] The wide age range allows the results to be generalized to a larger population of women with breast cancer.

Reproducibility and type of exercise programme

Reproducibility of the exercise programmes used in the studies is important clinically, as physiotherapists need this information to provide evidence-based treatment. Of the six included studies, only Morimoto and colleagues[22] described their exercise protocol clearly enough for a physiotherapist to reproduce the programme in practice. Morimoto and colleagues also provided instructions on progressing treatment as the patient improves over time postoperatively.[22] The other studies either did not describe the exercise programme specifically (i.e., frequency, intensity, time, type) or used exercise programmes individually tailored according to clinical judgment.[13,18–21] Therefore, the precise exercise parameters to be used to decrease shoulder pain related to breast cancer cannot be confirmed at this time.

A further limitation of the studies included for review is that the authors did not separate different types of exercise when analyzing their effectiveness in reducing shoulder pain related to breast cancer. Since cause and effect of each individual type of exercise cannot be determined, interpretation can only be made with regards to these exercises in general as a form of therapy. Therefore, we can only infer that a multi-factorial exercise programme may have an impact on shoulder pain related to breast cancer.

Follow-up

The length of the follow-up period is important in determining whether a reduction in shoulder pain related to breast cancer in women receiving exercise therapy is short-term or long-lasting. Only the study by Le Vu and colleagues[13] incorporated long-term follow-up (8–24 months). Thus, the long-term effects of exercise therapy in reducing shoulder pain related to breast cancer are unclear. Further studies need to examine whether improvements in shoulder pain are maintained over time.

CONCLUSIONS

The purpose of this systematic review was to determine the efficacy of therapeutic exercise as a treatment option to reduce shoulder pain related to breast cancer. Overall, our results provide preliminary evidence suggesting that exercise may be beneficial in treating shoulder pain in this patient population.

Based on the results of this systematic review, we offer the following recommendations. First, future research should involve studies with stronger methodological rigour, including larger sample sizes and true comparison groups. Second, studies incorporating longer follow-up periods are needed to assess the long-term benefits of exercise therapy on shoulder pain related to breast cancer. Third, rather than solely relying on oral self-report of pain severity, future studies should use valid and reliable outcome measures to assess pain levels, such as the VAS and BPI. Finally, rather than examining the effectiveness of a multi-factorial treatment protocol, future studies should focus on the efficacy of specific types of exercise in reducing shoulder pain in the breast cancer population. Comparisons can then be made to examine whether a multi-factorial treatment approach is superior to interventions focusing on a specific exercise protocol.

At this time, however, no definitive conclusions can be drawn from this systematic review because of a lack of high-quality evidence.

KEY MESSAGES

What is already known on this topic

Current research indicates that exercise therapy may reduce shoulder pain related to breast cancer treatment.

What this study adds

This systematic review highlights the need for clinicians to use pain-related outcome measures when implementing exercise therapy with women undergoing treatment of breast cancer. Further research of high methodological quality that includes long-term follow-up is needed to more definitively determine the efficacy of exercise therapy in reducing shoulder pain related to breast cancer.

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