Exercise Interventions for Upper-Limb Dysfunction Caused by Breast Cancer Treatment

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Review Question
What is the effect of exercise interventions for preventing, minimizing, and/or improving women’s upper-limb dysfunction from breast cancer treatment?

Type of Review
This is a Cochrane Review containing a meta-analysis of 24 randomized, controlled trials (RCTs).

Relevance to Nursing
Upper-limb dysfunction such as reduced range of motion (ROM) of the shoulder, muscle weakness of the upper extremities, lymphedema, and pain are common side effects of breast cancer treatment. For many breast cancer survivors, upper-limb dysfunction may persist for many years and affect quality of life. Shoulder exercises commonly are prescribed for patients to prevent or minimize these side effects; however, different views exist on what type of exercise is best and what the optimal time is to start upper-limb exercise following surgery. Some concern exists that unskilled or inappropriate methods for allocation concealment criteria. Ten were considered adequate. Twenty-one studies did not describe appropriate methods for allocation concealment and two had a high risk of bias in reporting incomplete outcome data.

Summary of Key Evidence
Studies were grouped by the type of comparison and timing of the exercise program relative to breast cancer treatment. The results were as follows.

Early Versus Delayed Exercise After Surgery
Shoulder flexion ROM: In the first-week assessment, a statistically significant benefit from early (i.e., intervention commenced day 1 to day 3 following surgery) exercise on shoulder flexion ROM in degrees was found (three studies, mean difference [MD] = 10.56 degrees; 95% confidence interval [CI] [4.51, 16.6]). The results varied in other individual studies with different types of outcome measures.

In the follow-up assessment, three studies found significant benefit from early exercise on shoulder flexion ROM in degrees at four to six weeks (MD = 12.12 degrees; 95% CI [0.35, 23.88]), but the analysis showed considerable statistical heterogeneity (I² = 89%). Two studies found no significant differences on the degrees limitation in shoulder flexion at one month and on the incidence of shoulder restriction at four to six months (four studies). One study that examined shoulder flexion in degrees at two years follow-up also found no statistically significant difference between the groups.

Shoulder abduction ROM: In the first-week assessment, a statistically significant benefit in favor of early exercise on shoulder abduction ROM in degrees was found (three studies, MD = 11.65; 95% CI [2.93, 20.38]). However, this analysis showed considerable heterogeneity (I² = 85%).

In the follow-up assessment, no statistically significant difference was found at four to six weeks postsurgery (three studies), with analysis showing considerable heterogeneity (I² = 93%). Statistically significant benefits from early exercise...
were found on shoulder abduction ROM in degrees at six months (two studies, MD = 4.31 degrees; 95% CI [1.38, 7.25]) and two years (one study, MD = 9 degrees; 95% CI [1.13, 16.87]) following surgery. No significant difference was observed on the degree limitation in shoulder abduction ROM found between the groups at six weeks (one study) and four months (one study).

**Wound drainage volume and duration:** Data from seven studies showed a statistically significant increase in wound drainage volume from early exercise (favoring delayed exercise) (standard mean difference (SMD) = 0.31; 95% CI [0.13, 0.49]). Pooled data also showed a statistically significant increase in drainage duration of about one day from early exercise (favoring delayed exercise) (five studies, weighted mean difference [WMD] = 1.15 days; 95% CI [0.65, 1.65]).

No statistically significant differences were found on incidence of seroma formation (five studies), mean number of fluid aspirations (three studies), delayed wound healing (four studies), and lymphedema (three studies) and pain.

**Exercise Versus Comparison After Surgery**

**Shoulder flexion ROM:** A benefit from exercise was found on shoulder flexion ROM in degrees within the first two weeks postoperatively (five studies, MD = 12.92 degrees; 95% CI [0.69, 25.16]); however, marked heterogeneity ($I^2 = 77\%$) was also found, as well as in the analyses at one month ($I^2 = 95\%$), three months ($I^2 = 79\%$), and six months follow-up ($I^2 = 77\%$). Subgroup analysis found statistically significant benefits in favor of physical therapy treatment at postintervention (three studies, MD = 19.35 degrees; 95% CI [14.08, 24.63]) and six months follow-up (two studies, MD = 15.31 degrees; 95% CI [10.93, 19.68]).

**Shoulder abduction ROM:** No statistically significant difference was found within the first two weeks (four studies). Statistically significant benefits from exercise were found at one month (three studies, MD = 22.05 degrees; 95% CI [0.97, 43.13]; $I^2 = 89\%$), three months (four studies, MD = 21.42; 95% CI [12.35, 30.52]; $I^2 = 72\%$) and six months follow-up (three studies, MD = 16.8; 95% CI [4.27, 29.33]; $I^2 = 80\%$). Because of the marked heterogeneity, subgroup analyses were performed. The pooled results showed statistically significant benefit in favor of physical therapy at postintervention (three studies, MD = 24.88 degrees; 95% CI [14.46, 35.3]) and continued benefit at six months follow-up (two studies, MD = 22.62 degrees; 95% CI [15.05, 30.19]).

No significant differences were found on incidence of seroma (one study), wound drainage volume (two studies), arm volume (one study), pain (one study), and incidence of lymphedema at one month (one study), three months (one study), six months (one study), one year (one study), and two years follow-up (one study).

**Exercise Versus Usual Comparison During Treatment**

Significant benefits were found in favor of exercise programs on shoulder abduction ROM (one study, MD = 11 degrees; 95% CI [2.38, 19.62]) and upper-extremity strength (one study, MD = 7.3 kg; 95% CI [4.42, 10.18]).

No statistically significant differences were found on shoulder flexion ROM (two studies), pain visual analog scale (one study), quality of life (three studies), and lymphedema (one study).

**Exercise Versus Usual Comparison After Treatment**

**Upper-extremity strength:** A significant effect was found on one-repetition maximum upper-extremity strength (one study, SMD = 1.49; 95% CI [0.83, 2.15]) in favor of resistance exercise group. No significant effect was found on upper-limb muscle strength as measured by a biodex isokinetic dynamometer (one study) between Tai Chi Chuan and a comparison group.

**Quality of life:** A statistically significant benefit was found in favor of exercise (three studies, SMD = 0.47; 95% CI [0.16, 0.77]).

No statistically significant differences were found on shoulder movement restriction (one study), the sum of shoulder ROM movements (one study), shoulder flexion ROM (two studies), shoulder abduction ROM (two studies), upper-extremity strength impairment (one study), incidence of lymphedema (one study), and arm circumference (one study).

**Best Practice Recommendations**

This review’s results favored early exercise interventions for the recovery of upper-limb movement in the short term following surgery for breast cancer. No evidence exists of adverse effects on incidence of seroma formation, pain, or lymphedema and delayed wound healing. Nurses should provide patients with information about upper-limb exercise and instruct them to start exercise early after surgery for better shoulder movement. Early exercise may cause more wound drainage, so nurses must observe this and explain to patients that drains should be kept in place longer. Nurses should advise those with an aversion to increased wound drainage and duration to delay rehabilitation exercise by about one week.

This review also showed that structured exercise programs are helpful in regaining shoulder mobility and functional capacity in the early weeks following surgery without causing adverse side effects. Nurses should give patients more supervised exercise instruction.

**Research Recommendations**

Most of studies included in this review did not fulfill all quality criteria. More methodologically rigorous studies are needed to confirm the research results. More detailed information on exercise prescription, measurement of shoulder ROM and function, and the adherence to exercise and adverse effects should be provided in future studies. Additional studies that examine the outcome of exercise, particularly the benefit of exercise in the short and long term, also are needed.

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**Reference**