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Developing an Evidence-Based Exercise Guideline on Improving Shoulder Motion and Lessening the Severity of Lymphedema for Breast Cancer Patients after Axillary Lymph-Node Dissection

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ABSTRACT Exercise is proven to be effective, safe and the preferred intervention for improving the range of shoulder motion of breast cancer patients who have undergone surgery for axillary lymph-node dissection. The application of evidence-based guidelines to clinical practice can help healthcare professionals to provide good quality care to patients and, in turn, produce better patient outcomes. The purpose of the present paper is to describe the development process of an evidenced-based guideline. Challenges in the implementation of evidence-based practice are identified and strategies for tackling them discussed.

KEY WORDS: breast neoplasms, surgery, exercise, range of motion, randomized controlled trial, review, guideline.

Introduction

The purpose of this paper is to describe the developmental process of evidenced-based guidelines. First, it provides an overview of the incidence of breast cancer and describes its primary treatment and common side-effects. Various benefits of developing evidence-based guidelines are then identified. Next, details are given of exercise guidelines developed by the authors. Also, challenges in implementing evidence-based practice in a clinical setting and strategies for tackling them are identified.

Incidence rate of breast cancer worldwide and in Hong Kong

Breast cancer is one of the most common forms of cancer among women worldwide. It accounts for 16% of all female cancers[1]. In Hong Kong, it ranks as the most common cancer and the third leading cause of cancer death in the female population. The crude incidence rate is estimated at 74.2 per 100,000 of the population, a rate that appears to have increased in the past ten years[2].

Primary treatment and its side-effects

Surgery remains the primary treatment for breast cancer. Various surgical options are available, depending on the extent of disease. Modified radical mastectomy is the standard treatment for operable locally advanced breast cancer. Breast conservation surgeries such as wide

local excision or lumpectomy are other preferred options for patients with less extensive cancer[3]. Although advanced cancer treatment increases the survival rate, patients still need to deal with the side-effects of treatment that affect their quality of life and health status. Among various treatment-related side-effects, decreased shoulder range of motion and lymphedema are common among post-operative breast cancer survivors[4].

The prevalence of impaired motion of the shoulder varies from 2% to 51%[4]. A decrease in the range of motion is a consequence of surgery and scarring of the healed wound, which decreases the amount of movement at each joint on the operated side[5,6]. Limited shoulder motion has adverse effects on patients' daily activities, such as difficulty in reaching over the head and fastening clothes from behind[4].

Decreased shoulder motion is closely linked to lymphedema, which hinders shoulder movement. The prevalence of lymphedema is about 10% to 30% in patients with axillary lymph node dissection[7]. It is an abnormal accumulation of protein-rich fluid, edema and chronic inflammation, with pain, tightness and heaviness being felt in the operated arm[8]. In addition to these physical effects, psychological stress is commonly caused by the distortion of body image.

Exercise has proven its effectiveness and is commonly used as an intervention to improve the physical health of cancer patients after treatment. The results of a systemic review support the effectiveness of exercise in increasing the range of shoulder motion after surgery without increasing the severity of the existing lymphedema[9].

Benefit of evidence-based guidelines

Evidence-based guidelines consist of systemically developed recommendations to assist healthcare professionals in providing the best quality of care based on the existing evidence rather than relying solely on expert opinion or anecdotal experience. Evidence-based guidelines may serve several purposes. First, they can provide and promote interventions of proven benefit, and discontinue current unproven ones. Second, they can help healthcare professionals to provide consistent care to patients, who will thus be cared for in a similar manner regardless of when and where they are treated. Third, they can serve as an easy checklist for healthcare professionals to follow. Fourth, they can offer explicit recommendations to healthcare professionals when they are uncertain how to proceed. Last, recommendations deriving from the best available evidence can ensure the appropriateness of the intervention, or lead to the abandonment of out-dated practice[10].

Development of evidence-based guidelines

Before developing the evidence-based guidelines, the authors conducted a systematic review to determine whether exercise was effective in improving shoulder motion and lessening the severity of lymphoedema. Details of the review are given elsewhere[9]. The results showed that exercises were effective in improving the range of shoulder motion but did not alter the severity of lymphedema. Details of the interventions used in selected studies are summarized in Table 1[11-16]. The types of intervention employed in these studies were used as key references in developing the guidelines.

Evidence-based exercise guidelines

The evidence-based exercise guidelines include recommendations on assessment methods and on how to perform exercises effectively. Rationales of the recommended evidence-based practice are also provided in the guidelines. The principles for grading the evidence and developing recommendations are based on the Scottish Intercollegiate Guidelines Network (SIGN) system[17] (Table 2). The level of evidence and grades of recommendation are assessed according to the quality of the selected studies and their applicability to the target population (Table 2).

Recommendation 1: Assessment

Perform pre-operative assessment of bilateral upper extremity range of motion by goniometer and of arm circumference by measuring tape on admission day by trained nurses (grade A recommendation).

Rationale: the baseline data, range of shoulder motion and arm circumference measured prior to intervention, are compared with data collected in the post-operative period, for clinical evaluation of the program's effect on range of shoulder motion and arm circumference (level 1+).

Assessment: various ranges of shoulder motion and arm circumference are measured at baseline so as to keep track of progress. Shoulder motion is measured by a goniometer in 4 positions: arm flexion, abduction, internal and external rotation[18]. The limit of reduced range of motion is set at 5% or higher for flexion and abduction, and 10% for internal and external rotation. The measurement end-point is reached when patients feel pain in movement or discomfort with tightness over the operated arm[16]. See Table 3 for details of measurement.

Arm circumference, bilateral, is measured with a tape at 4 points, metacarpal-phalangeal joints, wrists, 10 centimeters distal to and 15 centimeters proximal to lateral epicondyles. Markings are made at these 4 points for re-

Table 1. Interventions used by selected studies.

Selected studies	Interventions: Assessment method	Type of exercise (examples)	Commencement day	Frequency	Duration	Follow-up assessment
Ahmed et al. (2006)	Arm circumference	Weight training Stretching	4 months to 3 years post-operatively	Twice a week, repeat each set of exercises 8-10 times	6 months	6 months
Bendz & Olsen (2002)	Arm volume Range of motion	Range of motion	Post-operative day 1	3 times per day, repeat each set of exercise 5 times	Not mentioned	2 weeks 1 month 6 months 2 years
Beurskens et al. (2007)	Arm volume Range of motion	Range of motion Stretching Coordination Muscle strengthening exercise	Post-operative day 14	1-2 times per week, exercise for 10 minutes each time	3 months	3months 6 months
Cinar et al. (2008)	Arm circumference Range of motion	Range of motion Isometric Stretching	Post-operative day 1	Not mentioned	At least 8 weeks	day 5 1 month 3 months 6 months
Kilgour et al. (2008)	Arm circumference Range of motion	Range of motion Stretching	Post-operative day 3	Twice per day, exercise 5-7 minutes for each set	Not mentioned	day 14
Box et al. (2002)	Arm circumference Arm volume Range of motion	Not mentioned	Post-operative day 2	Not mentioned	Not mentioned	day 5 1 month 3 months 6 months 1 year 2 years

peated measurements. A 2-centimeter difference between the operated and non-operated arms is considered to indicate lymphedema[19].

Recommendation 2: Exercise

Post-operative range of motion exercise begins on days 1 and 2 after surgery, with active hand, wrist and elbow exercises performed on the affected side - for example, bend arms, squeeze a small soft ball, flex and extend the wrist (grade A recommendation).

Rationale: on post-operative days 1 and 2, active hand and elbow flexion and extension exercise, hand contraction and gently squeezing a soft ball is performed to stimulate lymph flow and keep the muscles in the arm, chest and back from tightening by performing light functional activities. The exercises may be modified for particular/individual purposes. Squeezing a ball in the palm of the hand is used to maintain the movement of forearm muscle flexors (level 1+).

From post-operative day 2 or 3 onwards, shoulder shrugging and an active range of motion exercises are taught, with active flexion, abduction and internal and external rotation of the shoulder joint - for example, shoulder circling, wall climbing, elbow pushing, hair combing, arm lifting and back drying (grade A recommendation).

Rationale: exercise intensity and degree of movement increases with active and assistive arm elevation and abduction to 90°, flexion, internal and external rotation of the shoulder joint on post-operative day 3. Shoulder shrugging and an active range of motion such as flexion and abduction to 90° can be added on post-operative day 2 (level 1+).

Following the range of motion exercises, stretching exercises are performed - for example, neck movement (grade A recommendation).

Rationale: continuing with stretching exercises helps to stretch the scar, preventing scar adhesions and maintaining muscle strength. It helps to keep stretching the levator scapula and maintaining range of motion. The neck movement is designed to assist the trapezius and other accessory muscles to prevent muscle spasm (level 1+).

Patients are encouraged to perform each exercise at least twice a day, about 5 minutes for each set of exercises, over a period of at least 8 weeks or until the baseline range of motion is achieved (grade A recommendation).

Rationale: exercises are performed at least 2 or 3 times daily, until pain is experienced. It is advisable to perform the exercises in a pain-free situation. Patients are recommended to continue

Table 2. SIGN grading system: levels of evidence and grades of recommendation.

Levels of evidence	
1++	High quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias
1+	Well-conducted meta-analyses, systematic reviews, or RCTs with a low risk of bias
1-	Meta-analyses, systematic reviews, or RCTs with a high risk of bias
2++	High-quality systematic reviews of case control or cohort studies High-quality case control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal
2+	Well-conducted case control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal
2-	Case control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal
3	Non-analytic studies, e.g. case reports, case series
4	Expert opinion
Grades of recommendation	
A	At least one meta-analysis, systematic review, or RCT rated as 1++, and directly applicable to the target population; or A body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results
B	A body of evidence including studies rated as 2++, directly applicable to the target population, and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 1++ or 1+
C	A body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 2++
D	Evidence level 3 or 4; or Extrapolated evidence from studies rated as 2+

Table 3. Measurements of range of shoulder motion.

Types of range of motion	Measurement method	Normal range
Flexion	With subject in sitting position, align the stationary arm of the goniometer along the side of trunk (sagittal plane) with the axis close to the acromion process The movable arm of the goniometer is parallel to the arm, using the lateral epicondyle of the humerus as reference The movable arm of the goniometer aligns with the arm as it moves in flexion Angle between the stationary and movable arms of the goniometer is the shoulder flexion angle	180°
Abduction	With subject in sitting position, align the stationary arm of the goniometer vertically with the side of trunk in the frontal plane with the axis close to the acromion process The movable arm of the goniometer is parallel to the arm, using the lateral epicondyle of the humerus as reference The movable arm of the goniometer moves along with the arm in abduction Angle between the stationary and movable arms of goniometer is the shoulder abduction angle	180°
Internal rotation	With subject in supine position, place arm in 90° abduction, elbow in 90° flexion with forearm perpendicular to table Stationary arm of goniometer aligned parallel to forearm with the axis over the oleranon process Movable arm of goniometer moves along with the forearm, using the styloid process of the ulna as reference Ensure there is no compensation by the shoulder girdle during movement Angle between stationary and movable arms of the goniometer is the shoulder internal rotation angle	70°
External rotation	Similar to that of internal rotation but shoulder and arm move in opposite direction	90°

the exercise guidelines at home for 8 weeks following discharge or until full range of motion is restored. Exercise also helps to stretch the scar and prevent adhesion (level 1+).

Recommendation 3: Follow-up assessment

Trained nurses to perform post-operative assessment by measuring the range of shoulder motion and arm circumference at each follow-up session, on post-operative day 5, and then 1 month, 6 months and 1 year after the operation, in the ward or outpatient department (grade A recommendation).

Rationale: prospective documentation of the factors that may affect range of shoulder motion and arm circumference in the post-operative period is made at each follow-up session. Measurement allows a comparison to be made with the pre-operative situation. The assessment method should adhere to the protocol. Regular fol-

low-up assessment may improve patient compliance in performing the recommended exercises at home (level 1+).

Barriers to the implementation of an evidence-based exercise program

While achievements in promoting evidence-based practice and quality of care have certainly been made, barriers are still encountered during the process of implementing such practices. One of the main ones is attitudes of healthcare professionals towards the implementation of this practice. Those with insufficient knowledge of its importance may be reluctant to change the current practice. Without objective data on improving patient outcomes and quality of care, they may not see the urgent need to change their existing practice. Also, such change may merely be perceived as giving up the existing practice and putting more effort and time into learning new ways. A sense of insecurity may affect healthcare professionals reluctant to learn new knowledge and skills. Also, the current heavy workloads and shortages of staff may be another barrier to carrying out evidence-based practice based on the recommendations of the guidelines.

Strategies to overcome the barriers

To overcome the barriers identified above, several strategies are suggested. One is simply to provide objective evidence to healthcare professionals. For example, by being shown the results of the summary of evidence, they may have a better understanding of the importance of using constructive and progressive exercise guidelines to speed up recovery of shoulder mobility without altering the severity of lymphedema. Also, evidence of improvement in patient outcomes and of reduction in existing workloads after implementing evidence-based practice can bring a better understanding of the positive effects of practice change and the importance of their own active participation in an evidence-based practice. To increase the confidence of healthcare professionals, training sessions should be conducted prior to implementation. Also, developing concise and user-friendly guidelines may help them to follow the recommendations step by step and provide consistent care to their patients. Integration of the new practice into routine care may also lead them to better planning and time management in the delivery of new practice to their patients.

Conclusion

The evidence-based exercise guidelines have been developed according to accurate and reliable evidence, which will help to give confidence to both healthcare professionals and patients in directing and following the guidelines in the post-operative period. As patients are usually in great stress and doubt about their recovery process after operation, the guidelines will help to assure patients that they are under consistent, reliable care. Using these guidelines to educate patients who have undergone surgery for axillary lymph-node dissection in breast cancer, our clinical practice will be more effective in improving patient outcomes and, in turn, the standard and quality of care.

Conflict of interest statement

No potential conflicts of interest were disclosed.

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