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EDITORIAL

Evidence-based recommendations regarding risk reduction practices for people at risk of or with breast cancer-related lymphedema: consensus from an expert panel

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Abstract
Several recent studies have investigated the validity of precautionary practices for lymphedema risk reduction after breast cancer treatment, such as avoidance of blood pressure measurements, skin puncture, blood draws, and use of prophylactic compression during air travel. Other studies have elucidated risk factors for breast cancer-related lymphedema, such as axillary lymph node dissection and skin infection (cellulitis). Combining the current evidence base with the consensus opinion of lymphatic experts assembled at the American Cancer Society/Lymphology Association of North America Summit in October 2023, updated evidence-based risk reduction recommendations are presented for those with or at risk of breast cancer-related lymphedema. Recommendation topics include prospective surveillance, patient education, individual risk factors, exercise, blood pressure, skin care and hygiene, skin puncture and blood draws, surgical procedures, prophylactic compression, air travel, and hot climate and sauna. These recommendations will help inform education and medical choices for individuals treated for breast cancer who are at risk of or diagnosed with breast cancer-related lymphedema. More high-quality evidence is required to allow the development of risk reduction recommendations for other cancer types such as gynecological, melanoma, and head and neck. It is recommended that clinicians and organizations serving people at risk of or with lymphedema align risk reduction guidelines with the evidence-based recommendations provided within this consensus document and companion manuscripts from the American Cancer Society/Lymphology Association of North America Lymphedema Summit: Forward Momentum: Future Steps in Lymphedema Management.

Keywords Lymphedema · Breast cancer · Risk reduction · Precautionary behaviors · Consensus · Expert panel

Introduction

Over the years, various patient advocacy groups and medical professionals have provided risk reduction guidelines for people with lymphedema and those at risk of developing lymphedema. These recommendations for risk reduction were developed based on an understanding of the physiology of the lymphatic system, the pathophysiology of lymphedema, and expert opinion based on clinical experience. However, many of these guidelines are more than a decade old. Recently, several studies have investigated the validity of former precautionary recommendations. Recognizing the gaps, multiple lymphologists have published research which includes the impact of current surgical techniques and oncological practice on lymphedema risk. Combining recent data with the consensus opinion of the lymphedema experts assembled at the American Cancer Society/Lymphology Association of North America Summit in October 2023, this panel has formulated updated evidence-based recommendations for individuals at risk of or with lymphedema.

Katherine Jackson and Shirin M. Shallwani have contributed equally to this work.

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Purpose

An invited panel of experts convened in St. Louis, Missouri for a two-day lymphedema research summit in October 2023, during which an exhaustive review of current research was summarized and presented. These summit presentations were followed by collaborative workgroups. The expert panel collectively considered lymphedema risks and precautionary behaviors. The evidence upon which these recommendations are based is reviewed in the manuscript 'Current Evidence on Patient Precautions for Reducing Lymphedema Manifestation and Progression Risks' [1].

This paper presents scientific evidence and the expert opinion of the assembled panel to provide updated, evidence-based recommendations for lymphedema risk reduction practices. As the majority of research is focused on breast cancer-related lymphedema (BCRL), the scope of this document is limited to BCRL.

Recommendations

Prospective surveillance

All people at risk of BCRL should have access to prospective surveillance (screening) for BCRL, including pre-operative baseline measurements (such as arm volume and/or bioimpedance spectroscopy measurements) and regular follow-up based on individual risk. Every person at risk needs instruction in self-monitoring. Screening for signs and symptoms of BCRL includes the limb(s), breast, and trunk on the side(s) of breast cancer treatment. Ideally, screening would continue for five years post-surgery as most people who develop BCRL do so within this timeframe [2, 3]. Prospective surveillance for BCRL has been well described in the literature and allows for early diagnosis and treatment and therefore decreased risk of later stage lymphedema, which is more challenging to treat than subclinical or early stage lymphedema [2]. Timely referral to a certified lymphedema therapist is essential to initiate treatment when necessary.

Education

Pre-operative and post-operative patient education should be tailored to the individual's level of understanding. For all people with or at risk of BCRL, the discussion should include individual risk factors and signs and symptoms of BCRL. If any signs or symptoms are noted between screening visits, the individual should contact the treating team.

Individual risk factors

Risk factors for BCRL include axillary lymph node dissection [2, 4–7], body mass index ≥ 25 kg/m^2 at the time of breast cancer diagnosis [2, 3, 5–8], regional lymph node radiation [5, 6, 8], certain chemotherapy regimens, skin infection [5, 7, 9] at or near the affected breast, axillary web syndrome (cording) [10], seroma [8], and Black race and Hispanic ethnicity [11].

Axillary lymph node dissection is the greatest known risk factor for lymphedema of the arm after breast cancer surgery [4]. Sentinel node biopsy, a less invasive surgical procedure, imparts lower, but not negligible, BCRL risk [2, 4].

Exercise

Supervised, slowly progressive resistance and aerobic exercise training is safe in people with or at risk of BCRL [12, 13] and is recommended in current exercise guidelines for people who have been treated for breast cancer.

Blood pressure

Isolated blood pressure (BP) measurements in the at-risk arm do not increase arm volume in those at risk of BCRL [6, 7, 9]. Best practice supports the avoidance of BP measurement in the affected arm of those with BCRL when possible. The effect of repetitive or cycling BP measurements, such as in the operating room, has not specifically been studied. When repetitive or cycling BP monitoring is required, best practice supports preferential use of the non-at-risk arm.

Skin care and hygiene

Skin infection has been shown to increase lymphedema risk [6–8]. Skin hygiene and protection of the area at risk of BCRL help reduce lymphedema onset and progression through the avoidance of infection. The area at risk of BCRL is defined as the breast, trunk, arm, and hand on the side of breast cancer surgery. Skin protection of these areas includes daily washing, moisturizing, and the use of sunscreen and insect repellent. Skin trauma, such as cuts, insect bites, and burns, requires first aid (e.g., cleansing the wound, applying an antibiotic ointment and a sterile dressing). The wound and surrounding area should be monitored for infection and new onset or worsening of swelling. In the event of an infection, immediate medical attention is required as these infections can spread quickly. Signs and symptoms of cellulitis infection include localized redness, swelling, and pain, and

may include lymphorrhea or blistering. In advanced cases, fever, chills, and sepsis may be present.

Skin puncture and blood draws

Isolated blood draws [6, 7, 9] and skin puncture for injection or aspiration [6, 7, 9, 14] in the at-risk arm have not been shown to increase arm volume in people at risk of BCRL. In contrast, the effect of skin punctures, blood draws, and injections on individuals with lymphedema has not been studied, and therefore, best advice supports avoidance of blood draws and injections in the arm with BCRL.

Surgical procedures

Studies regarding the effect of surgical procedures on the upper extremity at risk of or with BCRL are limited to small sample sizes and case reports. Although surgery, such as elective hand surgery, has not been associated with BCRL onset or exacerbation, some people may experience a temporary limb volume increase following surgery. People who may require elective surgery on the limb at risk of or with lymphedema are advised to discuss the risks and benefits of surgery with their treatment team, weighing the necessity of surgery and risk of BCRL exacerbation. People should be provided with close prospective surveillance and/or ongoing intervention for BCRL throughout the pre- and post-operative time periods as indicated.

Prophylactic compression

One study has shown that prophylactic use of compression sleeves post-operatively for individuals at high risk of lymphedema (with axillary lymph node dissection) may reduce and delay lymphedema onset in the first year after surgery for breast cancer [15]. Post-operative prophylactic compression may be considered for people at high risk following axillary lymph node dissection.

Air travel

Air travel has not been found to be a significant risk factor for those at risk of BCRL onset [6, 7, 14].

As consistent compression is best practice for maintenance, those with BCRL should wear their compression garments during air travel. Any compression garments worn

Evidence-based recommendations regarding Risk reduction practices for people AT RISK for Breast Cancer-Related Lymphedema (BCRL)	Evidence-based recommendations regarding Risk reduction practices for people WITH Breast Cancer-Related Lymphedema (BCRL)
PROSPECTIVE SURVEILLANCE	**PROSPECTIVE SURVEILLANCE**
• Seek access to screening for lymphedema, including baseline measurements of the affected areas. • Request follow-up for five years on measurements, etc., as the risk for BCRL is life-long.	• Continue following up with your Certified Lymphedema Therapist (CLT) or other trained professional every 6-12 months for compression garment fitting and to ensure BCRL does not worsen.
INDIVIDUAL RISK FACTORS	**INDIVIDUAL RISK FACTORS**
• **Type of surgery**: lymph node dissection poses 3x greater risk than sentinel node biopsy • **Patient factors**: BMI >25 at breast cancer diagnosis, Black race, Hispanic ethnicity • **Treatment factors**: lymph node radiation, some types of chemotherapy • **Complications**: skin infection/cellulitis, seroma, cording	• Patient factors: BMI >30 • Complications: skin infection/cellulitis, seroma, cording
PATIENT EDUCATION	**PATIENT EDUCATION**
• Seek education before and after surgery on personal risk factors and symptoms of BCRL.	• Seek education about the signs and symptoms of BCRL getting worse.
EXERCISE	**EXERCISE**
• Supervised, slowly progressive, strengthening, and cardio exercise is safe and encouraged.	• Supervised, slowly progressive, strengthening, and cardio exercise is safe and encouraged.
BLOOD PRESSURE	**BLOOD PRESSURE**
• Isolated blood pressure measurement has **not** been shown to trigger the onset of BCRL.	• If possible, avoid blood pressure measurement in the arm with BCRL.
BLOOD DRAWS AND INJECTIONS	**BLOOD DRAWS AND INJECTIONS**
• Isolated blood draws/injections have **not** been shown to increase arm volume in people at risk for BCRL.	• If possible, avoid blood draws, injections and infusions in the arm affected by BCRL.
SKINCARE AND SKIN INFECTION	**SKINCARE AND SKIN INFECTION**
• Skin protection (sunscreen, bug repellant) and hygiene of the affected area are important. • Apply first aid to cuts and scratches to avoid infection/cellulitis, which increases the risk for BCRL. • Seek immediate medical attention if any signs and symptoms of infection/cellulitis appear.	• Skin protection (sunscreen, bug repellant) and hygiene in the affected area are important. • Apply first aid to cuts and scratches to avoid skin infection/cellulitis, which can worsen BCRL. • Seek immediate medical attention if any signs and symptoms of infection/cellulitis appear.
ELECTIVE SURGERY POST BREAST CANCER TREATMENTS	**ELECTIVE SURGERY POST BREAST CANCER TREATMENTS**
• Discuss with the surgeon the benefits and risks of any elective surgery and its impact on the area at risk. • Request lymphedema assessment before and immediately following surgery.	• Discuss with your surgeon the benefits and risks of elective surgery and its impact on BCRL. • Request lymphedema assessment before and immediately following surgery.
PROPHYLACTIC COMPRESSION	
• Post-surgical compression garments that are well-fitted may help prevent BCRL in people at high risk.	
AIR TRAVEL	**AIR TRAVEL**
• Air travel has **not** been associated with an increased risk of BCRL. • If you prefer to wear a preventative garment during travel, ensure it is properly fitted.	• Although there is no evidence that BCRL progresses with air travel, people with BCRL should wear well-fitting compression garments during air travel as part of a self-maintenance program.
TEMPERATURE	**TEMPERATURE**
• Hot climate does **not** appear to increase the risk for the onset of BCRL. • Saunas should be avoided.	• Exposure to hot temperatures may slightly increase swelling in people with BCRL. • Individuals are encouraged to self-monitor when exposed to high temperatures. • Saunas should be avoided.
SELF-MONITORING	**SELF-MONITORING**
• Self-monitor for any individual triggers that may cause early swelling. • Seek timely treatment from a Certified Lymphedema Therapist if signs and symptoms arise.	• Self-monitor for individual triggers that may cause swelling to get worse. • See a Certified Lymphedema Therapist or other trained professional should your BCRL get worse.

Fig. 1 Summary of breast cancer-related lymphedema risk reduction recommendations

during air travel should be well-fitted, as poorly fitting garments may cause discomfort or swelling.

Hot climate and sauna

Hot climate has not been found to be a significant risk factor for those at risk of BCRL but may transiently affect limb measurements and perceived swelling in those with BCRL [14, 16, 17].

Sauna use may be a risk factor for the onset or progression of BCRL [9]. People are encouraged to self-monitor when exposed to high temperatures.

Conclusions

More high-quality evidence is required to allow the development of risk reduction recommendations for other cancer types such as gynecological, melanoma, and head and neck.

We recommend that clinicians and organizations serving people at risk of or with BCRL align their risk reduction guidelines with the recommendations provided within this consensus document and companion manuscripts from the American Cancer Society/Lymphology Association of North America Lymphedema Summit: Forward Momentum: Future Steps in Lymphedema Management. These recommendations are summarized in Fig. 1. We encourage the use of this figure in clinical practice.

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Declarations

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