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A comparison of systolic blood pressure in women with and without lymphedema following surgery for breast cancer

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by

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Table of Contents

List of Tables

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ABSTRACT

There is no evidenced-based research on prevention of upper extremity lymphedema following breast cancer treatment. General guidelines have been identified from a basic understanding of the lymphatic system and are considered to be prudent advice for prevention. Cause of lymphedema is hypothesized to be multifactorial and time of onset is widely varied. Exogenous risk factors leading to lymphedema are the removal and destruction of lymph nodes; however, not all women develop lymphedema following axillary lymph node dissection. Co-morbid conditions such as obesity, diabetes, and hypertension are cited as possible endogenous risk factors. Several studies identify hypertension as a significance endogenous risk factor resulting in increased capillary filtration causing an increase in the fluid load on an already compromised lymph drainage system. This retrospective chart review was designed to compare systolic blood pressure in two matched groups to determine if there is a difference between groups. The study population included 147 stage II and III breast cancer patients. After receiving IRB approval, charts of patients with a diagnosis code of

lymphedema (n=19) were identified from the 147 possible charts. A matching sample of 18 women without lymphedema was assembled. Vital sign records were then reviewed and 3 measures of systolic blood pressure were used from a time period of two to 15 moths after lymph node dissection. Results revealed mean age and number of lymph nodes removed in the two groups were equivalent. No significant difference in systolic blood pressure was found between the two groups. However, he study was limited by the lack of chart data on the variables of lymphedema and systolic blood pressure This pilot study pointed out adjustments needed to capture a more diverse sample. Other limitations such as missing demographic data on race, number of participants treated with radiation to the axilla and records of ambulatory blood pressure should be included in future studies.

Chapter I

Introduction

As part of the surgical treatment and staging of breast cancer, axillary lymph nodes that drain the breast are removed. When choosing the best adjuvant treatment for individual patients, an important factor to consider is the number of lymph nodes involved with cancer. Axillary lymph node status is an important prognostic factor for patients with breast cancer; however, this procedure is associated with considerable morbidity (National Comprehensive Cancer Network [NCCN], 2005). Lymphedema is among the most visible side effects after treatment for breast cancer. Lymphedema can occur in any quadrant drained by the affected nodal bed leading to truncal edema, breast edema or upper extremity edema (Muscari, 2004). The surgical technique of sentinel lymph node biopsy has been shown to be an effective alternative to complete axillary lymph node dissection for staging of breast cancer. However, if sentinel lymph nodes are found to be involved with cancer, a complete axillary node dissection is necessary (NCCN, 2005). Lymphedema is a condition that can be treated and managed over a lifetime but cannot be cured. Problems associated with lymphedema are pain, discomfort, disability, alteration in body image, and difficulty fitting clothing (Ridner, 2002).

The number of reported occurrences of lymphedema varies widely; this may be due to the fact that definition and measurement vary substantially among studies. A study

done by Kwan et al. (2002) reported approximately 50% of patients screened were symptomatic and 12.5% of those screened had measurable lymphedema. Petrek, Senie, Peters, and Rosen (2001) reported that approximately 400,000 women cope with lymphedema on a daily basis. In another clinical study on incidence and risk, one in five of the study sample developed lymphedema. Of those women, 80% developed lymphedema by one year post surgery (Clark & Harlow, 2005). In a cohort study over a twenty-year time period, Petrek, et al. (2001) found that out of 263 women, 77% reported swelling within 3 years of diagnosis, and the remaining women developed symptoms gradually over the subsequent 17 years. Studies vary on the percentages of women who develop lymphedema, but they agree that in the majority of women lymphedema develops more often during the first three years after surgery, and incidence tapers in years to come.

Lymphedema occurs when arterial capillary filtration exceeds lymphatic transport capacity. Fluid is continuously filtered from the capillaries into the interstitium. Ninety percent of the fluid is reabsorbed into the venous system; ten percent of that fluid is filtered and transported from the interstitium by the lymphatic system back to the vascular system (Ridner, 2002). Transport capacity is diminished by removal or destruction of lymph nodes. Once there has been an excision and/or radiation to the nodal basin, the capacity to transport and filter the lymphatic load is curtailed. This results in a reduced capacity to transport and filter protein, water, metabolic wastes, viruses and bacteria. Any further overloading of the transport capacity has the potential to trigger the onset of chronic lymphedema (Schuch, 2001). Lymphedema is not simply lymphatic obstruction; it is a complex sequence of events, and research is needed throughout this

evolving process. Evidence suggests hemodynamic factors, if not causal, may contribute to lymphedema (Mortimer, 1998). In addition to diminished transport capacity, studies have shown that there is an increase in blood flow to the edematous arm when compared to the non-edematous arm. This may lead to increased capillary filtration into an arm with impaired lymphatic transport capacity (Bates, Levick & Mortimer, 1994; Stanton, Levick & Mortimer,1996). Studies have identified hypertension as a possible contributing factor to lymphedema; and treatment for hypertension was found to be a protective factor (Bates, et al., 1994; Deo, et al., 2004; Engel, Kerr, Shlesinger-Raab, Sauer, & Holzel, 2003; Geller, Vecek, O'Brien, & Secker-Waler, 2003; Herd-Smith, Russo, Grazia Muraca, Rosselli Del Turco, & Cardona, 2001). One limitation to these studies is that, like the definition of lymphedema, the definition of hypertension varies among studies. Consideration of the damage to the lymphatic system along with hemodynamic factors is an important step to understanding potential risk factors of lymphedema after treatment for breast cancer (Ridner, 2002).

Published clinical practice guidelines for lymphedema offer suggestions to prevent lymphedema based on interventions that make clinical sense, although the evidence supporting their suggestions is limited and anecdotal (Harris, Hugi, Olivotto, & Levine, 2001). The National Lymphedema Network (NLN) has published prevention guidelines; these guidelines are a listing of prudent advice based on a basic understanding of the lymphatic system (Schuch, 2001). The NLN guidelines have been strengthened and updated since they were first published in 1990 to reflect the current level of knowledge in the world of lymphology. However, it is noted that the lack of evidence-based data continues to make it difficult to justify these guidelines (Thiadens, 2005).

There have been no randomized controlled trials or cohort studies to provide evidence based interventions designed specifically to prevent lymphedema after breast cancer treatment (Erickson, Pearson, Ganz, Adams & Kahn, 2001). In the absence of evidence-based prevention measures, NLN's risk reduction guidelines should be included in patient teaching when explaining precautions that may reduce risk of lymphedema (Ridner, 2002).

Problem and Purpose

After axillary lymph node dissection, secondary upper extremity lymphedema may develop, once established, it is a chronic and incurable morbidity of treatment. It is imperative for patients to be aware of their lifelong risk of developing lymphedema to enable them to make informed decisions (Ridner, 2002). There is a lack of evidence-based research and interventions to prevent lymphedema after breast cancer surgery. Prevention and physical therapy are the focus when teaching patients about lymphedema (Muscari, 2004). Health care practitioners find it difficult to provide patients with estimates of their chances of developing lymphedema or when lymphedema can most likely occur (Erickson et al., 2002).

The presence of hypertension has been shown to be a significant factor in the development of lymphedema after treatment for breast cancer (Deo, et al., 2004; Engel, et al. 2003; Geller, et al., 2003). However, standards for the definition of hypertension are not consistent across studies. The purpose of this study was to explore the relationship between elevated blood pressure and the development of lymphedema in women treated for breast cancer.

Research Question

The following question was the focus of this study:

Is there a significant difference in the mean systolic blood pressure between two matched samples, one with and one without lymphedema, within the first 15 months following treatment for breast cancer?

Hypothesis: Women with a diagnosis of lymphedema will experience an increased prevalence of elevated systolic blood pressure compared to a matched sample of women without lymphedema.

Definition of Terms

Secondary upper extremity lymphedema is defined as the accumulation of lymph fluid in the arm and/or hand after surgical removal of lymph nodes and/or radiation therapy as treatment for breast cancer. (Cornish et al., 2000). For the purposes of this retrospective chart review, a documented diagnosis of lymphedema evidenced by a diagnosis code for lymphedema in the patient chart defined the presence of lymphedema.

Hypertension is defined by the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure in stages Pre hypertension is a systolic BP of 120-139 or a diastolic BP of 80-89; stage 1 hypertension is a systolic BP of 140-159 or diastolic BP of 90-99; stage 2 hypertension is a systolic BP of $\geq$160 or a diastolic BP of $\geq$100. Blood pressure is considered elevated if systolic BP is increased by 20mmHg or if diastolic BP is increased by 10mmHg based on the mean of two or more BP readings on each of two or more office visits (Chobanian et al., 2003).

Significance

At this time, there is no evidenced-based research available for clinicians to teach their patients on prevention of lymphedema. Since lymphedema may occur immediately after surgery or later in life, there is a need to teach life-long precautions. These precautions require considerable lifestyle modifications for an undefined amount of time. Clinicians struggle with standards of care that are not evidence-based and the need to teach effective prevention measures (Muscari, 2004). This study may shed light on the importance of recognizing elevated blood pressure and controlling hypertension as one evidence-based method for preventing or controlling lymphedema.

Chapter II

Review of Literature

This chapter reviews and summarizes current knowledge of the incidence, prevalence, diagnosis, time of onset, and risk factors of secondary upper extremity lymphedema following treatment for breast cancer. This review of literature focuses on type of cancer treatment and co-morbidities which are risk factors for developing breast cancer related upper extremity lymphedema. The chapter concludes by reviewing elevations in blood pressure as a possible modifiable risk factor in need of further study.

Incidence and Prevalence of Lymphedema

In a review of literature from 1985 to 1999, Erickson, Pearson, Ganz, Adams, and Kahn (2001) reported incidence of lymphedema varied with surgical procedure, breast cancer therapy, definition of lymphedema, and time from surgery to onset of lymphedema. Estimates of the incidence of lymphedema range from 6% to 86 % (Clark, Sitzia, & Harlow, 2005). The American Cancer Society estimates that there will be 212,920 new cases of invasive breast cancer diagnosed in 2006 (American Cancer Society [ACS], 2005). At best, 12,775 of those women will develop lymphedema and at worst, 183,111 will develop lymphedema after treatment for breast cancer. In a retrospective analysis conducted over a 15 month time frame, Deo et al. (2004) found the prevalence of clinically significant lymphedema was 13.4% for patients who were treated with surgery alone and 42.4% for patients treated with surgery and radiation.

Diagnosis of Lymphedema

The diagnosis of lymphedema is generally made by medical history and physical exam. There are a wide range of subjective and objective evaluation methods; the methods most used are patient questionnaire, sequential circumferential measurement and volume measurement. A limitation of the research reviewed is that there is no standardization of measurement or consistency in methods of measurement (Erikson et al., 2001).

Subjective Measurements

Patient reported symptoms and questionnaires are often used to determine the presence and complications of lymphedema. Questionnaires were used by researchers in a study to assess the nature and severity of arm complaints as well as to determine if they interfere with activities of daily life, psychosocial functioning, and quality of life (Ververs et al. 2001). Considerable thought and planning to test and validate questionnaires is necessary (Norman, Miller, Erikson, Norman, & McCorkle, 2001). A number of studies have used questionnaires along with telephone interviews; co-morbidities were not the focus of these methods. Qualities of life, impact on daily life, and severity of symptoms have been measured. Questions on co-morbidities present at the time of onset of lymphedema, specifically hypertension, were not analyzed in these questionnaires (Vevers et al., 2001; Engle et al., 2003; Goffman et al., 2004).

Objective Measurements

Objective measures have varied as well, most studies have relied on sequential circumferential arm measurements because this is a simple, cost effective, reproducible and reliable method to define and determine the presence of lymphedema. However,

quantification varies among studies. In one study the definition was determined to be a finding of greater than or equal to a two centimeters difference in the circumference of the affected and non-affected arm (Armer & Fu, 2005). In another, the difference of three centimeters between arms (Deo et al., 2004), and still another considered a difference of greater than five percent between arms (Herd-Smith, 2001). Points of measurement also have varied, circumference measurements have been taken at various intervals from the hand to the shoulder. Some used anatomical points on the arm, others measured from anatomical points on the arm. The simplest method used the elbow as the point of reference and recorded three areas to be measured at predetermined distances from the elbow (Petrek et al., 2001).

Because of differences in the methods used to determine the presence of lymphedema, the numbers have varied widely, and prevalence of lymphedema after treatment for breast cancer is difficult to determine. In addition, distribution of swelling in the affected arm is often uneven and can develop anywhere between the shoulder and the hand (Stanton et al., 2001). The definition of secondary lymphedema after treatment for breast cancer varies among studies; in some studies subjective findings are enough while in others they are accompanied by objective findings.

Time of Onset of Lymphedema

Four patterns of acute lymphedema have been identified: the first, occurring within a few days of surgery; the second, six to eight weeks postoperatively; the third, after insect bite or burn; and the fourth, is usually insidious having a variable onset about eighteen to twenty-four months after surgery (Lymphedema PDQ, 2005). In an effort to identify prevalence, time of onset, and associated predictive factors related to

lymphedema, Petrek, Senie, Peter, and Rosen (2001) conducted a cohort study spanning a 20 year time period. They found that the interval to onset of lymphedema symptoms was reported by 77% of the cohort to have occurred within the first three years after treatment. The subsequent rate was 1% per year. Herd-Smith, et al. (2001) found that the cumulative probability of lymphedema reached 10% in the two years following surgery. Results of a cohort study conducted over an eight year time frame by Geller et al. (2003) estimated a cumulative incidence of lymphedema at one year to be 18% and 35% at two years. They compared their findings with those of Kiel and Rademaker who found a cumulative incidence of 8% at one year and 35% at 20 months follow-up.

Risk Factors for Lymphedema

Surgery and Radiation Therapy

Surgery and radiation therapy are the main known causative factors for lymphedema following treatment for breast cancer. A review of literature from 1985 to 1999 showed that axillary node dissection and/or axillary radiation therapy were found to carry the highest risk for lymphedema as well as pain, paresthesias, weakness, and impaired shoulder function (Erickson, et al., 2001). In a retrospective cohort study over a three year time period no patient with fewer than five nodes removed developed arm edema (Goffman, et al., 2004).

Co-morbidities

Co-morbidities have emerged as significant risk factor for lymphedema following treatment for breast cancer. Co-morbidities focused on by clinical studies have been obesity, diabetes, and hypertension; research has identified treatment for hypertension to be a protective factor. Geller et al. (2003) noted significant decreased risk of arm

swelling among women who were on treatment for hypertension. Bohler et al. (1992) noted that the incidence of lymphedema after treatment with axillary surgery and irradiation was 35% among patients with normal blood pressure or controlled hypertension, and 61 percent for patients with hypertension ($p<0.005$). Engle et al. (2003) found that hypertension and diabetes were significant contributors to lymphedema ($p<0.003$). Petrek et al. (2001) collected data on the presence or absence of co-morbidities. The two most common chronic illnesses of the cohort were diabetes mellitus 11% and hypertension 17.5%; no mention of how chronic illness effects risk of lymphedema was made.

Elevated Blood Pressure as a Modifiable Risk Factor

Studies have shown that hypertension may be a risk factor for lymphedema and hypertension is a prevalent health problem among women in the United States. Cardiovascular disease (CVD) claims the lives of more women than breast cancer. A Harris poll commissioned by the American Heart Association in 2003 revealed that only 13 percent of American women believed that CVD presents the greatest health threat to women (American Heart Association [AHA], 2004). The pathophysiology of the development of lymphedema involves additional mechanisms other than lymphatic damage (Bates et al., 1994). Lymphedema depends on fluid capillary filtration to the affected arm as well as the inability to transport fluid due to removal and/or destruction of lymph nodes. Studies have indicated that angiogenesis occurs in the skin of the affected arm after treatment for breast cancer and that increased capillary surface area for filtration could result in an increase in fluid load on an already compromised lymph drainage system (Stanton, Levick, & Mortimer, 1997). Angiogenesis has also been

hypothesized as a contributing factor (Stanton et al., 2001) Consideration of the hemodynamic factors as well as the damage to the lymphatic system is key in understanding the pathophysiology of lymphedema (Ridner, 2002)

Definition of Elevated Blood Pressure and Hypertension

The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC VII) was commissioned in response to the need to update guidelines on hypertension. The new guideline added pre-hypertension as a category for the classification and management of hypertension. A systolic blood pressure of 120 to 139 mmHg or diastolic blood pressure of 80 to 89 mmHg are now considered pre-hypertension. If blood pressure is $\geq$ 20/10mmHg above goal blood pressure, consideration should be given to initiating therapy. It is estimated that among people age 18 to 74 years old, 30% are unaware they have hypertension (Chobanian, et. al, 2003).

Prevalence of Hypertension

In the United States hypertension (HTN) is the most common primary diagnosis comprising 35 million offices visits in the year 2000. In 2003 CVD was the first listed diagnosis of 3,196,000 women discharged (both alive and dead) from short-stay hospitals. Of those women, 299,000 women were diagnosed with HTN and 31,065 women died from HTN. Before age 45 the incidence of HTN is greater in men than women; by age 45 to 54 this trend changes. In 2003, women represented 53.1 percent of deaths related to CVD in the United States (AHA, 2004). Between the years of 1999 and 2002, the U.S. Department of Health and Human Services estimated the percentage of women with elevated blood pressure or who are taking antihypertensive medication by

age group as; 15.1% among ages 35-44, 31.8% among ages 45-54, 53.9% among ages 55-64, 72.7% among ages 65-74; and women age 75 and over have an 83.1% chance of having elevated blood pressure or will be taking antihypertensive medications(AHA, 2004). It is logical to assume that in many subjects' elevations in blood pressure and the diagnosis of true hypertension is missed by clinical blood pressure assessment alone. Studies show ambulatory blood pressure monitoring to be effective in determining hypertension. Conversely, elevations in blood pressure and heart rate during a clinic visit (white coat hypertension) may be misinterpreted (Paolo et al., 2004). A limitation of the studies reviewed was that ambulatory blood pressure (ABP) is not considered. In future prospective studies ABP should be evaluated to detect isolated ambulatory hypertension and effects of white coat hypertension.

Summary

Surgery and radiation therapy are the primary insults to the axillary lymphatic system and are presumably the root cause of lymphedema by reducing the lymph transport capacity. The status of the axillary lymph nodes is an important prognostic indicator and is used to direct choices of adjuvant therapy for patients with breast cancer. Since there is no cure for lymphedma, the combination of axillary dissection and radiotherapy should be avoided when feasible. Although less extensive surgeries have been developed such as sentinel lymph node biopsy, if the sentinel nodes are involved with disease, complete axillary dissection often follows (NCCN, 2005). The wide variation in reported occurrences of lymphedema may be due to varied procedures for diagnosing lymphedema (Ridner, 2002). Studies have challenged the assumption of a higher prevalence of lymphedema and related symptoms among older versus younger

breast cancer survivors. Armer and Fu (2005) found that the occurrence of lymphedema was 30.6% for women older than 60 and 41.2% for women younger than 60.

Study findings suggest the possibility of hypertension as a modifiable risk factor, considering increased venous pressure and increased capillary filtration in an arm that has been compromised by the removal or destruction of lymph nodes. The studies reviewed showed four significant factors contributed to arm problems: extent of axillary surgery, radiation therapy to the axilla, younger age, and co-morbidities, specifically hypertension. New guidelines on the definition of hypertension tell us that we need to reevaluate which patients we consider to be hypertensive. A Harris poll tells us that women are not recognizing hypertension as a condition more dangerous than breast cancer (AHA, 2004). The presence of elevations in blood pressure or hypertension is often a secondary concern in the shadow of a diagnosis of cancer. The role that treatment for high blood pressure may play in protecting women from lymphedema needs further study. This study explored elevations in blood pressure as a possible modifiable risk factor for secondary upper extremity lymphedema.

Chapter III

Methods

This was a retrospective case matched study conducted by chart review. This section outlines the research methods used to explore the relationship between elevations in blood pressure and the development of secondary upper extremity lymphedema following treatment for breast cancer. First, population, sample, characteristics of the sample, inclusion and exclusion criteria are described. Second, procedures for collecting data are presented. Finally, the method of data analysis is discussed.

Population, Sample and Setting

The target population included medical records of patients treated for breast cancer at a National Cancer Institute-designated cancer center located in the southeastern United States. The sample consisted of medical records of Stage II and III breast cancer patients. All women who met study criteria were evaluated. Those records were then matched with medical records of women who had not been diagnosed with lymphedema. A sample of 50 women was sought.

Inclusion Criteria

Data were collected from charts of patients who had been diagnosed with Stage II or III breast cancer and had a lymph node dissection as part of treatment for breast cancer. Surgical procedures included were; lumpectomy and/or mastectomy with node

dissection of 5 or more lymph nodes, women who had a contra-lateral prophylactic mastectomy without lymph node dissection were also included.

Exclusion Criteria

Patients who had had bilateral lymph node sampling or dissection, a prior diagnosis of breast cancer, history of prior surgery for breast cancer or benign breast disease with a lymph node dissection in the affected arm, metastatic cancer, or have developed metastasis during the first three years were excluded from the chart review. Patients without complete medical records were not included in this chart review.

Study Variables

Data included pre-operative age, systolic blood pressure, and number of lymph nodes removed. Interval systolic blood pressure was collected from 1 month up to 15 month time frame. Charts were matched by age and number of axillary nodes removed.

Procedures

The study plan was approved by the Comprehensive Breast Cancer Program Leader and the Moffitt Scientific Review Committee. Following those approvals, the proposal was approved by the Institutional Review Board (IRB) of the University of South Florida. Waiver of informed consent was given (Appendix A). With the approval of the IRB, data collection began.

A chart review was conducted by the primary investigator over a three week period. No patient names, dates of birth, medical record numbers or other personally identifiable information was collected. All records were included that met the requirements for the group; within that group, diagnosis codes were used to find women with a diagnosis of lymphedema and the group without the diagnosis of lymphedema.

Medical records were reviewed at a secure computer terminal at the Moffitt cancer research center. Biographic data was reviewed in Power Chart, collected and recorded on the bioform. Data were directly entered in to an Excel database and SPSS software was used in the analysis of the data.

Data Analysis

The two groups in this study were matched by key characteristics of age and number of lymph nodes removed. To determine if there is a difference in mean systolic blood pressure between the lymphedema group and the non-lymphedema group a t-test was used to compare the means of the systolic blood pressures.

Chapter IV

Results, Discussion and Conclusions

This chapter presents study findings and discussion of the data. It begins with an initial discussion of demographic data and continues with analysis of data as it relates to the research questions. The chapter concludes with recommendations for further study.

Results

Sample

The sample consisted of 147 Stage II and III breast cancer patients who were surgically treated with axillary lymph node dissection from January 2000 to January 2003. From that sample 27 patients developed lymphedema within the first 36 months; 19 of the 27 met the lymphedema group inclusion criteria, these were matched with 18 patients with no diagnosis of lymphedema. Mean age and number of lymph nodes dissected were equivalent between groups(Table 1).

Table 1. *Mean Age and Number of Nodes Removed*

		Mean		Mean Number of		
	n	Age	SD	Nodes Removed	Range	SD
Lymphedema	19	55.6	7.9	17.8	9-27	7.8
Non-Lymphedema	18	55.8	7.6	18.2	8-33	5.6

Stages of Hypertension Among Groups

The systolic blood pressures for both groups were evaluated for fit into the hypertension classifications set by the JNC VII guidelines. Although most patients fit into the Pre-HTN classification, some patients in each group were classified as having Stage 1 or 2 hypertension (Table 2).

Table 2. *Study Groups Hypertension Classification By JNC VII Guidelines*

	Lymphedema		Non-Lymphedema	
	Frequency	Percent	Frequency	Percent
Pre-HTN	17	89.4	14	77.7
Stage 1 HTN	1	5.3	2	11.1
Stage 2 HTN	1	5.3	2	11.1
Total	19	100	18	99.9

Systolic Blood Pressure and Lymphedema

To answer the research question, is there a significant difference in the mean of the systolic blood pressures between two matched samples, one with and one without lymphedema, systolic blood pressures were compared. Three systolic blood pressures documented during three clinic visits at least two months apart were used were used to determine if there was a difference between groups. The time frame was from two months after lymph node dissection up to 15 months following treatment.

Independent t tests were performed to determine the mean systolic blood pressure differences between groups. No significant differences were found between the two groups (Table 3).

Table 3. *Independent t Test Comparison of Mean Systolic Blood Pressure*

	Lymphedema		Non-Lymphedema			
	n	Mean	n	Mean	t	p
Systolic #1	19	128.6	18	127.7	.16	.87
Systolic #2	19	125.4	18	126.5	.16	.87
Systolic #3	19	124.4	18	130.8	.91	.36
Mean Systolic	19	126.1	18	128.3	.41	.68

Discussion

Sample

A limitation of the demographic data was that race was not taken into consideration. It is known that African-American women suffer from higher rates of hypertension than women of other races (AHA, 2004). The data collection process was complicated by the fact that vital signs were not completely documented in the charts and in some charts there was no documentation of vital signs at all. For this reason, after reviewing charts from the study population of 147 women only 19 out of the available 27 who qualified for the lymphedema group fit inclusion criteria for this study and only 18 out of the 110 of the non-lymphedema group had adequate documentation of vitals signs for inclusion in this study. The lack of documentation of vital signs may indicate that this

is not an area that is scrutinized during patient visits. The assumption of white coat hypertension or problems of higher priority may have overshadowed these observations. Possibly, because of this the connection between lymphedema and elevated blood pressure is not an observation that can be made on a daily basis as a risk factor for lymphedema. This study is different from studies reviewed in that it relied on the presence of a diagnosis code for lymphedema to identify patients who were diagnosed as having developed lymphedema. Although it is a logical assumption that between physician documentation and physical therapy provided for lymphedema a diagnosis code would be generated; this retrospective method of determining presence of lymphedema is only as reliable as physician reports of an existence of lymphedema and may not be any more reliable for identifying patients with lymphedema than patient questionnaire.

Although this was a small sample of patients the two groups were very comparable in age and total number of nodes removed. This was a strength of this study. A larger sample with better representation may have had a different more generalizable outcome.

Stages of Hypertension Among Groups

Stages of hypertension were also very similar among groups. Both groups had the largest portion of patients in the Pre-HTN stage. It is estimated that among people age 18 to 74 years old, 30% are unaware they have hypertension and since the latest JCN VII guidelines were published many clinicians may not consider the new pre-HTN stage with a systolic range from 120 to 139 mmHg to be of concern during medical oncology clinic visits when taking patient anxiety into consideration. These two misconceptions may lead

to underestimating the significance of elevated blood pressure and hypertension in relation to the onset of lymphedema. Another possible explanation for this finding could be that the women were taking antihypertensive medications. A limitation of this study was that medication data were not available.

Systolic Blood Pressure and Lymphedema

The results show that there is no significant difference in systolic blood pressure between the two groups. Previous studies have indicated a relationship between hypertension and lymphedema (Bates, et al., 1994; Deo, et al., 2004; Engel, Kerr, Shlesinger-Raab, Sauer, & Holzel, 2003; Geller, Vecek, O'Brien, & Secker-Waler, 2003; Herd-Smith, Russo, Grazia Muraca, Rosselli Del Turco, & Cardona, 2001). The lack of relationship in this study may be due to the small sample size that was dictated by the availability of data on the variable of systolic blood pressure. The two groups consisted of women between the ages of 55 and 56 years old. This is a very narrow age group, and does not represent the spectrum of age groups in the study sample. This group is not generalizable to the study population of stage II and III breast cancer patients.

The American Heart Association estimates that among ages 55 to 64, 53.9% of women will have a problem with elevated blood pressure or will be taking antihypertensive medication. In this study 89% of the lymphedema groups were in the pre-HTN stage and there was one patient in Stage I and II HTN. In the non-lymphedema group 77% of the patients were in the pre-HTN group and 2 each had stage I and II HTN (Chobanian et al., 2003). This patient sample has a higher percent than estimated by the American Heart Association.

Conclusions

The results show no difference in systolic blood pressures between groups however, this preliminary study had many limitations, such as adequate retrospective data availability. The ages of the women available for inclusion in the two groups were very similar; this was a strength of the study. Further investigation into the hemodynamic factors as one of the modifiable risk factor for lymphedema is warranted.

Recommendations for Future Research

Future prospective studies should include standardized measures for presence and severity of lymphedema, use of JNC VII stages of blood pressure, and better documentation to determine time of onset of lymphedema so that it can be compared to the time of occurrence of elevated blood pressure. Future prospective studies may help shed light on the relationship between elevated blood pressure and treatment for hypertension on the occurrence of lymphedema after axillary lymph node dissection.

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Appendices A: Letter of IRB Exempt Certification

June 21, 2006

Deborah M. Arvidson-Hawkins, RN College of Nursing 12011 Driver Lane Springhill, FL 34610

RE: **Exempt Certification** for Application for Exemption
IRB#: 104758C
Title: The Relationship Between Lymphedema and Elevated Blood Pressure in Women Following
Surgery for Breast Cancer - MCC 14891

Dear Ms. Arvidson-Hawkins:

On 06/20/2006, the Institutional Review Board (IRB) determined that your Application for Exemption
MEETS FEDERAL EXEMPTION CRITERIA Exemption 4 - Existing data, documents, records, pathological specimens, or diagnostic specimens publicly available or recorded without identifiers.
It is your responsibility to ensure that this research is conducted in a manner consistent with the ethical principles outlined in the Belmont Report and in compliance with USF IRB policies and procedures.

Please note that changes to this protocol may disqualify it from exempt status. It is your responsibility to notify the IRB prior to implementing any changes.

The Division of Research Compliance will hold your exemption application for a period of five years from the date of this letter or until a Final Review Report is received. If you wish to continue this protocol beyond the five-year exempt certification period, you will need to submit an Exemption Certification Request form at least 30 days before this exempt certification expires. The IRB will send you a reminder notice prior to expiration of the certification; therefore, it is important that you keep your contact information current. Should you complete this study prior to the end of the five-year period, you must submit an Application for Final Review. **Please reference the above IRB protocol number in all correspondence** to the IRB or the Division of Research Compliance. In addition, we have enclosed an Institutional Review Board (IRB) Quick Reference Guide providing guidelines and resources to assist you in meeting your responsibilities when conducting human subjects research. Please read this guide carefully.

Barry B Brown MD