“PROSPECTIVE STUDY OF COMPARING AXILLARY LYMPHNODES USING AXILLARY REVERSE MAPPING DURING MODIFIED RADICAL MASTECTOMY”

MADURAI MEDICAL COLLEGE AND GOVERNMENT RAJAJI HOSPITAL, MADURAI

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BONAFIDE CERTIFICATE

This is to certify that the dissertation entitled **"PROSPECTIVE STUDY OF COMPARING AXILLARY LYMPHNODES USING AXILLARY REVERSE MAPPING DURING MODIFIED RADICAL MASTECTOMY"**conducted in **MADURAI MEDICAL COLLEGE AND GOVERNMENT RAJAJI HOSPITAL, MADURAI** submitted by **Dr.KARTHIKEYAN.R** to the Tamil Nadu Dr. M.G.R. Medical University, Chennai in partial fulfilment of the requirement for the award of M.S. Degree Branch I (General Surgery) is a bonafide research work was carried out by him under my direct supervision & guidance.

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This is to certify that the dissertation entitled **"PROSPECTIVE STUDY OF COMPARING AXILLARY LYMPHNODES USING AXILLARY REVERSE MAPPING DURING MODIFIED RADICAL MASTECTOMY" IN MADURAI MEDICAL COLLEGE AND GOVERNMENT RAJAJI HOSPITAL, MADURAI** is a bonafide research work done by **Dr.KARTHIKEYAN.R,** Post Graduate Student, Department of General Surgery, MADURAI MEDICAL COLLEGE AND GOVERNMENT RAJAJI HOSPITAL, MADURAI, under the guidance and supervision of **Dr.K.SARAVANAN, M.S,** Professor Department of General Surgery, MADURAI MEDICAL COLLEGE AND GOVERNMENT RAJAJI HOSPITAL, MADURAI.

DATE : **Prof.Dr.VANITHA.MD, DCH**

PLACE: Madurai **DEAN**

MADURAI MEDICAL COLLEGE

DECLARATION

I, **Dr.KARTHIKEYAN.R** declare that, I carried out this work on, **"PROSPECTIVE STUDY OF COMPARING AXILLARY LYMPHNODES USING AXILLARY REVERSE MAPPING DURING MODIFIED RADICAL MASTECTOMY" IN MADURAI MEDICAL COLLEGE AND GOVERNMENT RAJAJI HOSPITAL, MADURAI**, at the Department of General Surgery, Govt. Rajaji Hospital during the period of **September 2018 to September 2019.** I also declare that this bonafide work or a part of this work was not submitted by me or any others for any award, degree, diploma to any other University, Board either in India or abroad. This is submitted to The Tamilnadu Dr.M.G.R. Medical University, Chennai in partial fulfillment of the rules and regulations for the M.S. degree examination in General Surgery.

Place: Madurai

Date: **Dr.KARTHIKEYAN.R,**

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Dr.KARTHIKEYAN.R.

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INTRODUCTION

Lymphedema is a morbidity that is faced by breast cancer patients after Modified radical mastectomy with axillary dissection in spite of all hard efforts done to reduce the invasiveness of the surgery. In the literature its incidence ranges from (11.8 - 53.5)% for axillary lymph node dissection and (zero - 15.8)% for sentinel lymph node procedure. Before the introduction of the sentinel lymph node biopsy (SLNB) in the early 1990s, axillary lymph node dissection (ALND) was the standard care in the treatment of breast cancer patients. Although the SLNB introduced a minimally invasive procedure for breast cancer staging, a substantial proportion of breast cancer patients are still scheduled for primary or completion ALND for tumour staging and optimising locoregional control .The virtually unknown variations in arm lymphatic drainage put the arm lymphatics at risk for disruption during ALND. In 2011 Devoogdt N et al, concluded that the short term manual lymph drainage in addition to guidelines and exercise therapy didn't have considerable effect in decreasing the arm lymphedema rate after axillary lymph node dissection for breast cancer.Due to this result and with presence of much variations in arm lymphatic drainage that put these lymphatics at risk of disruption during

axillary lymph node surgery, hence the need for mapping of axillary lymphatics become a must and floated to the surface introducing itself as an important and irreplaceable step during axillary surgeries. Mapping the drainage of the arm with blue dye and preserving the identified lymphatics would help in identification and decrease the likelihood of disruption of the lymphatics draining the arm during ALND.

AIMS AND OBJECTIVES

The aim of this study is to identify and preserve the nodes draining arm from those draining breast using reverse axillary mapping technique in patients undergoing modified radical mastectomy in preventing lymphedema complication.

REVIEW OF LITERATURE

In the second century AD, Galen, on his classical clinical observation of a breast carcinoma said: “We have often seen in the breast a tumor exactly resembling the animal the crab. Just as the crab has legs on both sides of his body, so in this disease the veins extending out from the unnatural growth take the shape of a crab's legs. We have cured this disease in its early stages, but after it has reached a large size, no one has cured it”. Beginning with Morgagni, surgical resections were more frequently undertaken, including some early attempts at mastectomy and axillary dissection. German pathologist Rudolf Virchow studied the morbid anatomy of breast cancer. He undertook a series of postmortem dissections and postulated that breast cancer spreads along fascial planes and lymphatic channels .

In 1867, CJI. Moore, of the Middlesex Hospital, London reemphasized complete resection of the breast for cancer and stated that palpable axillary lymph nodes should also be removed. In a presentation before the British Medical Association in 1877, Banks supported Moore's concepts and advocated the resection of axillary lymph nodes even when palpable lymphadenopathy was not evident; recognizing that occult involvement of axillary lymph nodes was frequently present.

In 1894, Halsted and Meyer reported their operations for treatment of

breast cancer. By demonstrating superior loco-regional control rates after radical resection, these surgeons established radical mastectomy as state of the art for that era. Both Halsted and Meyer advocated complete dissection of axillary lymph node levels I to III. Resection of the long thoracic nerve and the thoracodorsal neurovascular bundle with the axillary contents was routine. This technical maneuver contributed significantly to the surgical management of the disease .

However, in 1943, Haagensen and Stout described the grave signs of breast cancer, which included(a) edema of the skin of the breast; (b) skin ulceration; (c) chest wall fixation: (d) an axillary lymph node greater than 2.5 cm in diameter; and (e) fixed axillary lymph nodes. Women with two or more signs had a 42% local recurrence rate and only a 2% 5-year disease free survival. Based on the findings, they declared that women with grave signs were beyond cure by radical surgery. Approximately 25% of women were excluded from surgery based on the criteria of in-operability. Presently, with comprehensive mammography screening, approximately 10% of women are found to have advanced breast cancers.

A technical and aesthetic advance was proposed in 1948, when Patey and Dyson of the Middlesex Hospital, London, advocated "'modified radical" mastectomy for the management of advanced operable breast cancer . The technique espoused by these surgeons included removal of the breast and

axillary lymph nodes with preservation of the pectoralis major muscle. They showed that removal of the pectoralis minor muscle allowed access to and clearance of axillary lymph node levels I to III (Patey modification). Today, the modification is frequently limited to severance of the origin of the pectoralis major muscle at the coracoid process of the scapula. Subsequent to the description of the Patey modification, Madden advocated a modified RM that preserved both the pectoralis major and minor muscles even though this approach prevented complete dissection of the apical (level III) axillary lymph nodes. With familiarity and experience in performance of the technique, by the 1980s, the surgical procedure most frequently used by American surgeons for breast cancer was modified radical mastectomy.

The transition from the Halsted radical mastectomy to the modified radical mastectomy acknowledged that (a) extirpation of the pectoralis major muscle was not essential for loco- regional control in stage I and stage II breast cancer and (b) neither modified radical mastectomy nor Halsted radical mastectomy consistently achieved loco-regional control of stage III breast cancer.

The National Surgical Adjuvant Breast and Bowel Project B-04 (NSABP B-04) conducted by Bernard Fisher and co-investigators thereafter compared local and regional treatments of breast cancer. Life table estimates were obtained for 1,665 women enrolled and followed for a mean of 120 months . This study

randomized clinically node-negative women into three groups:

(a) Halsted radical mastectomy; (b) total mastectomy plus radiation therapy (TM+RT); and (c) total mastectomy alone (TM). Clinically node positive women were treated with radical mastectomy or TM+RT. After a median follow-up of 10 years, there were no differences in survival between the three groups of node negative women or between the two groups of node positive women.

Other prospective clinical trials comparing Halsted radical mastectomy to the modified radical mastectomy were the Manchester Trial, reported by Turner and colleagues, and the University of Alabama trial, reported by Maddox and colleagues. In both studies, the type of surgical procedure did not influence recurrence rates for stage I and stage II breast cancer patients. Criteria for accrual to the Alabama Breast Cancer Project (1975 to 1978) included T1 to T3 breast cancers with absence of clinically apparent distant metastases. Patients received a radical or a modified radical mastectomy. Node-positive patients received adjuvant cyclophosphamide, methotrexate, and 5-fluorouracll (CMF) chemotherapy or adjuvant melphalan. After a median follow-up of 15 years. neither type of surgery nor type of chemotherapy was shown to affect loco-regional disease-free or overall survival. Since the 1970s, considerable progress has been made in the integration of surgery, radiation therapy, and chemotherapy to control loco-regional disease, to enhance survival, and to increase the

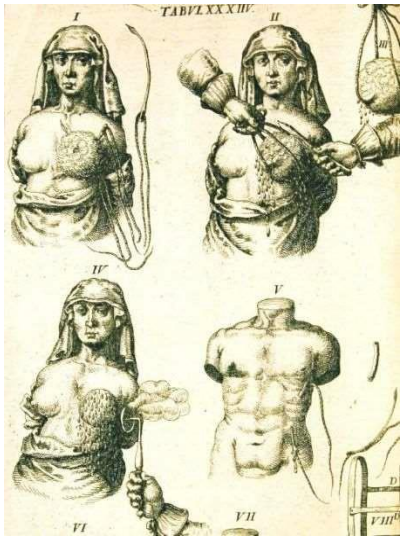
possibility of breast conservation. Loco- regional control is now achieved for nearly 80% of women with advanced breast cancers.

Chronological history of operations related to total mastectomy :

Author	**Year**	**Treatment**
Halsted	1890	Radical Mastectomy
Patey	1948	Modified Radical Mastectomy
McWhirter	1948	Simple Mastectomy & Radiotherapy
Toth	1991	Skin Sparing Mastectomy
Noguchi	1996	Sentinel Lymph Node Biopsy
VerHeyden	1998	Subcutaneous Mastectomy(Malignant Diseae)

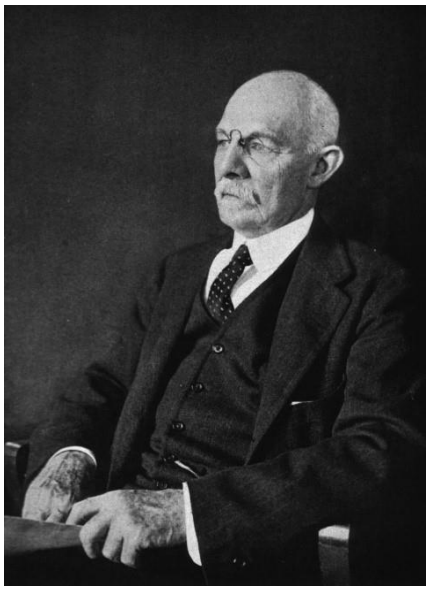
Chronological history of operations related to partial mastectomy:

Author	**Year**	**Treatment**
Crile	1973	Partial Mastectomy
Montague	1978	Breast Conservation Therapy
Veronesi	1994	Segmental parenchymal Excision
Gabka	1997	Oncoplastic Surgery
Clough	1998	Reduction Mastopexy Lumpectomy
Amanti	2002	Periareolar parenchymal Excision
Anderson	2005	Parallelogram excision Patterns



Breast amputation,17th Century

Rudolf Virchow



William Halsted

Willy Meyer

Over the years, as our understanding of the pathophysiology of breast cancer has improved and our utilization of radiation therapy as an adjuvant mode

of therapy was optimized, modifications to these original operations have evolved. It became accepted that for many breast cancers total mastectomy was not an absolute requirement; a partial mastectomy could be performed. With the introduction of breast conservation therapy (BCT), breast cancers could be excised with a 2–5 mm margin, the NAC could be preserved, and breast shape and contour would be maintained in the majority of women. Following the operative portion, radiation therapy is initiated. The outcomes following BCT have been generally favorable, with survival statistics that have remained essentially equal to that of MRM . However, local recurrence rates have been generally increased . Although the aesthetic outcomes following BCT have been good to excellent in the majority of women, some have required secondary procedures to improve the appearance and achieve symmetry. Thus, the shortcomings of BCT have included increased local recurrence and occasional breast distortion.

In an effort to reduce the incidence of local recurrence and maintain natural breast contour, the concept of oncoplastic surgery was introduced . Oncoplastic surgery differs from standard BCT in that the margin and volume of excision are typically greater than in lumpectomy or quadrantectomy. Excision margins typically range from 1 to 2 cm and resection volumes typically range from 180 to 220 cm^3, although much greater margins and volumes are possible. The resultant deformity is reconstructed immediately using techniques related to

volume replacement or volume displacement that include adjacent tissue rearrangement, reduction mammoplasty, or distant flaps. Oncoplastic techniques have resulted in survival and local recurrence rates that are essentially equal to those of MRM .

EMBRYOLOGY

Breast tissue is embryologically derived and anatomically matures as a modified sweat gland. Mammary tissues represent a unique feature of the mammalian species. Embryologically, the paired mammary glands congruently develop within the ·milk line which mends between the limb buds from the primordial axilla distally to the inguinal area. The number of paired glands varies widely among the various mammalian species, but in humans and most primates, only one pair of glands normally develops in the pectoral region, one gland on each side. In approximately 1% of the female population, supernumerary breasts (polymastia) or nipples (polythelia) may develop. Supernumerary appendages principally develop along the milk lines. While there is normally minimal additional development of the mammary gland during postnatal life in the male, in the female extensive growth and development are evident. Evident postnatal development of the female mammary gland is related to age and is primarily regulated by hormones (estrogens) that influence reproductive function.

BREAST

The breasts form a secondary sexual feature of females and are a source of nutrition for the neonate. In young adult females, each breast is a rounded eminence largely lying within the superficial fascia anterior to the upper thorax but spreading laterally to a variable extent. Breast shape and size depend on genetic, racial and dietary factors and on the age, parity and menopausal status of the individual. Breasts may be hemispherical, conical, variably pendulous, piriform or thin and flattened. In the adult female, the base of the breast, i.e. its attached surface, extends vertically from the second or third to the sixth rib, and in the transverse plane from the sternal edge medially almost to the mid-axillary line laterally. The superolateral quadrant is prolonged towards the axilla along the inferolateral edge of pectoralis major, from which it projects a little, and may extend through the deep fascia up to the apex of the axilla (the axillary tail of Spence). The trunk superficial fascial system splits to enclose the breast to form the anterior and posterior lamellae. Posterior extensions of the superficial fascial system connect the breast to the pectoralis fascia, part of the deep fascial system. The inframammary crease is a zone of adherence of the superficial fascial system to the underlying chest wall at the inferior crescent of the breast.

The breast lies on the deep pectoral fascia, which in turn overlies pectoralis major and serratus anterior superiorly and external oblique and its aponeurosis inferiorly, as the latter forms the anterior wall of the rectus sheath.

Between the breast and the deep fascia, the loose connective tissue in the 'sub mammary space' allows the breast some degree of movement on the deep pectoral fascia.

Nipple & Areola:

The nipple projects from the center of the breast anteriorly. It may be cylindrical and rounded, hemispherical or flattened, depending on the effects of developmental, nervous or hormonal factors and external temperature on the erectile properties of the sub areolar muscle of the nipple. The level of the nipple varies widely. In females, its site is dependent on the size and shape of the breasts; it overlies the fourth intercostal space in most young women. In the male, the nipple is usually sited in the fourth intercostal space in the midclavicular line. In the young adult of either sex, the nipples are usually positioned 20–23 cm from the suprasternal notch in the mid-clavicular line and 20–23 cm apart in the horizontal plane. With increasing age and parity, female breasts adopt a more ptotic shape and the position of the nipple drops to the level of the inframammary crease or below. In the nulliparous, the nipple is pink, light brown or darker, depending on the general melanization of the body. The skin covering the nipple and the surrounding areola (the disc of skin that circles the base of the nipple) has a convoluted surface. It contains numerous sweat and sebaceous glands that open directly on to the skin surface. The oily secretion of these specialized sebaceous glands acts as a protective lubricant and facilitates

latching of the neonate during lactation; the glands are often visible in parous women, arranged circumferentially as small elevations, Montgomery's tubercles, around the areola close to the margin. Other areolar glands, intermediate in structure between mammary and sweat glands, become enlarged in pregnancy and lactation as subcutaneous tubercles. The sebaceous glands of the areola are not usually associated with hair follicles. The skin of the nipple and areola is rich in melanocytes and is therefore typically darker than the skin covering the remainder of the breast; further darkening occurs during the second month of pregnancy, and subsequently persists to a variable degree.

The breasts are composed of lobes that contain a network of glandular tissue consisting of branching ducts and terminal secretory lobules in a connective tissue stroma. The terminal duct lobular unit is the functional milk secretory component of the breast; pathologically, it gives rise to primary malignant lesions within the breast. Although the lobes are usually described as discrete territories, they intertwine in three dimensions and merge at their edges; they cannot be distinguished during surgery. The connective tissue stroma that surrounds the lobules is dense and fibro collagenous, whereas intra lobular connective tissue has a loose texture that allows the rapid expansion of secretory tissue during pregnancy. Fibrous strands or sheets consisting of condensations of connective tissue extend between the layer of deep fascia that covers the muscles of the anterior chest wall and the dermis. These suspensory ligaments (of Astley

Cooper) are often well developed in the upper part of the breast and support the breast tissue, helping to maintain its non-ptotic form. Elsewhere in the normal breast, fibrous tissue surrounds the glandular components and extends to the skin and nipple, assisting the mechanical coherence of the gland. The inter lobar stroma contains variable amounts of adipose tissue, which is responsible for much of the increase in breast size at puberty.

Axilla:

The anatomical boundaries of the axilla represent a pyramidal compartment located between the upper extremity and the thoracic wall; this structure has four boundaries inclusive of a base and an apex. The curved oblong base consists of axillary fascia. The apex of the axilla represents an aperture that extends into the posterior triangle of the neck via the cervico axillary canal. Most structures that course between the neck and the upper extremity enter this anatomic passage. which is bounded anteriorly by the clavicle. medially by the first rib. and posteriorly by the scapula. The anterior wall of the axilla is composed of the pectoralis major and minor muscles and their associated fasciae. The posterior wall is formed primarily of the subscapularis muscle, located on the anterior surface of the scapula, and to a lesser extent by the teres major and latissimus dorsi muscles. The lateral wall of the axilla is the bicipital groove, a thin strip of condensed muscular tissue between the insertion of the musculature of the anterior and posterior compartments. The medial wall is

composed of the serratus anterior muscle. The fascia of the pectoralis major and minor muscles are evident in two distinct planes:

The superficial layer, called the pectoral fascia, invests the pectoralis major muscle, whereas the deep layer, called the clavipectoral or costocoracoid fascia. Extends from the clavicle to the axillary fascia in the floor of the axilla and encloses the subclavius and the pectoralis minor muscle. The costocoracoid membrane represents the upper portion of the clavipectoral fascia and is pierced by the cephalic vein, the lateral pectoral nerve, and branches of the thoracoacromial trunk. The medial pectoral nerve does not penetrate the costocoracoid membrane, but enters the deep surface of the pectoralis minor and passes through the anterior investing fascia of the pectoralis minor to innervate the pectoralis major muscle. Caudad portions of the clavipectoral fascia, which are anatomically inferior to the pectoralis minor are sometimes referred to as the suspensory ligament of the axilla or the coracoaxillary fascia. Many surgeons refer to this anatomic landmark as Halsted's ligament, which represents a dense condensation of the clavipectoral fascia that extends from the medial aspect of the clavicle, attaches to the first rib, and invests the subclavian artery and vein as each traverse the first rib. Within the axilla are the great vessels and nerves of the upper extremity, which, together with the other a:xillary contents, are encircled by loose connective tissue. These vessels and nerves are anatomically contiguous and are enclosed within an investing layer of fascia referred to as the

axillary sheath.

The axillary artery can be divided into three anatomical segments within the axilla proper:

1. Located medial to the pectoralis minor muscle, the first segment gives rise to one branch, the supreme thoracic, which supplies the upper thoracic wall inclusive of the first and second intercostal spaces.

2. The second segment of this artery, located immediately posterior to the pectoralis minor, gives rise to two branches, the thoracoacromial trunk and the lateral thoracic artery. Pectoral branches of the thoracoacromial and lateral thoracic arteries supply the pectoralis major and minor muscles. Identification of these vessels during surgical dissection of the axilla is imperative to provide safe conduct of the procedure. The lateral thoracic artery gives origin to the lateral mammary branches.

3. The third segment of this vessel, located lateral to the pectoralis minor muscle, gives rise to three branches. These include the anterior and posterior humeral circumflex artery that supply the upper arm, and the subscapular artery, which is the largest branch within the axilla. After a short course, the subscapular artery gives origin to its terminal branches, the subscapular circumflex and the thoracodorsal arteries. The thoracodorsal artery, which courses with its corresponding nerve and vein, crosses the subscapularis muscle, providing its substantial blood supply, as well as that of the serratus anterior and

latissimus dorsi muscles.

Tributaries of the axillary vein follow the course of the branches of the axillary artery, usually in the form of venae comitantes, paired veins that follow the course of the artery. The cephalic vein passes in the groove between the deltoid and pectoralis major muscles, and thereafter enters the axillary vein after piercing the clavipectoral fascia. Anatomically, the axillary artery is contiguous with various portions of the brachial plexus throughout its course in the axilla. The cords of the brachial plexus are named according to their structural and positional relationship with the axillary artery-medial, lateral, and posterior rather than their anatomic position in the axilla or on the chest wall. The three nerves of principal interest to surgeons that are located in the axilla: The long thoracic nerve, located on the medial wall of the axilla, arises in the neck from the fifth, sixth, and seventh cervical roots (CS. C6, and C7) with entry in the axilla via the cervicoaxillary canal. This medially placed nerve lies on the lateral most surface of the serratus anterior muscle and is invested by the serratus fascia such that it might be accidentally divided together with resection of the fascia during surgical dissection (sampling) of lymphatics of the axilla. The long thoracic nerve, although diminutive in size, courses a considerable anatomic distance to supply the serratus anterior muscle, injury or division of this nerve results in the '"winged scapula" deformity with denervation of the muscle group and the inability to provide shoulder fixation. The thoracodorsal nerve takes

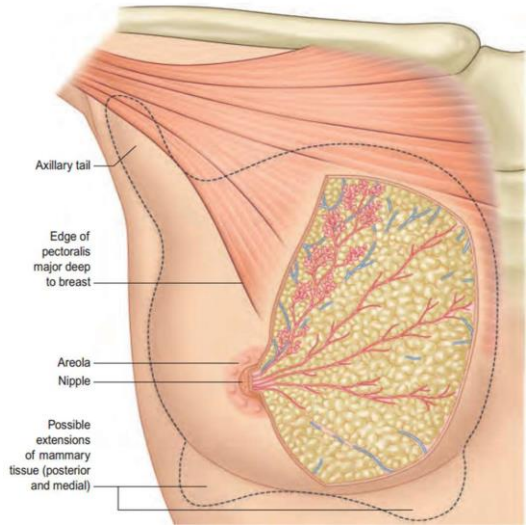
origin from the posterior cord of the brachial plexus and innervates the laterally placed latissimus dorsi muscle. Injury or division is inconsequential to primary shoulder function; however, preservation of this nerve is essential to provide transfer survival and motor function preservation for the myocutaneous flap used for the latissimus dorsi musculocutaneous reconstruction. The intercostobrachial nerve is formed by the merging of the lateral cutaneous branch of the second intercostal nerve with the medial cutaneous nerve of the arm; this nerve provides sensory innervation of the skin of the apex and lateral axilla and the upper medial and inner aspect of the arm. A second intercostobrachial nerve may sometimes form an anterior branch of the third lateral cutaneous nerve.

Blood Supply of Breast

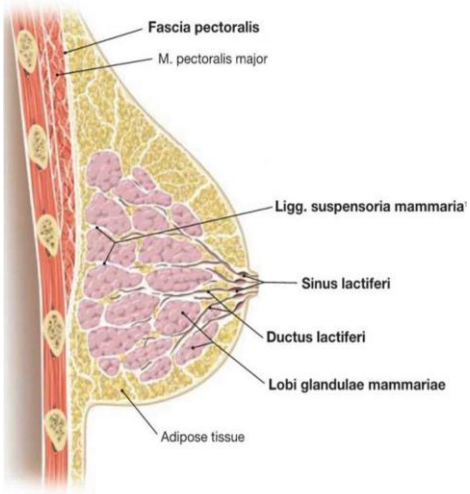
Blood supply to the mammary gland is derived from perforating branches of the internal mammary artery, lateral branches of the posterior intercosta1 arteries, and several branches of the axillary artery. The latter vessels include the highest thoracic, lateral thoracic, and pectoral branches of the thoracoacromial artery. Branches from the second, third, and fourth anterior perforating arteries pass to the breast as medial mammary arteries. The lateral thoracic artery branches allow perfusion to the serratus anterior muscle, both the pectoralis muscles, and the subscapularis muscle, and also supply the axillary lymphatics and supporting fatty tissues. The posterior intercostal arteries give rise to mammary branches in the second, third, and fourth intercostal spaces. Although

the thoracodorsal branch of the subscapular artery does not contribute to the primary blood supply of the breast per se, this vessel is intimately associated with the central and scapular lymph node groups of the axilla. This fact should be taken into consideration during axillary node dissection, as bleeding that is difficult to control can result when penetrating branches of this vessel are severed. Principal venous outflow of the gland has preferential directional flow toward the axilla, with the veins principally paralleling the path of the arterial distribution. The superficial venous plexus of mammary parenchyma has extensive anastomoses that may be evident through the overlying skin. Circumscribing the nipple, superficial veins form an anastomotic circle, the circulus venosus. Veins from this circle and from deeper aspects of the gland converge to drain blood to the periphery of the breast, and thereafter into vessels that terminate in the internal mammary, axillary, and internal jugular yeins. Venous return from the gland is derived from three principal groups of veins providing drainage of the breast and the thoracic wall and include (a) perforating branches of the internal mammary vein, (b) tributaries of the axillary vein, and (c) perforating branches of posterior intercostal veins. The posterior intercostal veins lie indirect continuity with the vertebral plexus of veins (Batson's plexus) that surround the vertebrae and extend from the base of the skull to the sacrum. Clinically, this plexus may provide an important pathway for hematogenous dissemination of breast cancer, and may physiologically account for metastases to the skull, vertebrae, pelvic bones, and enteral nervous system in the absence

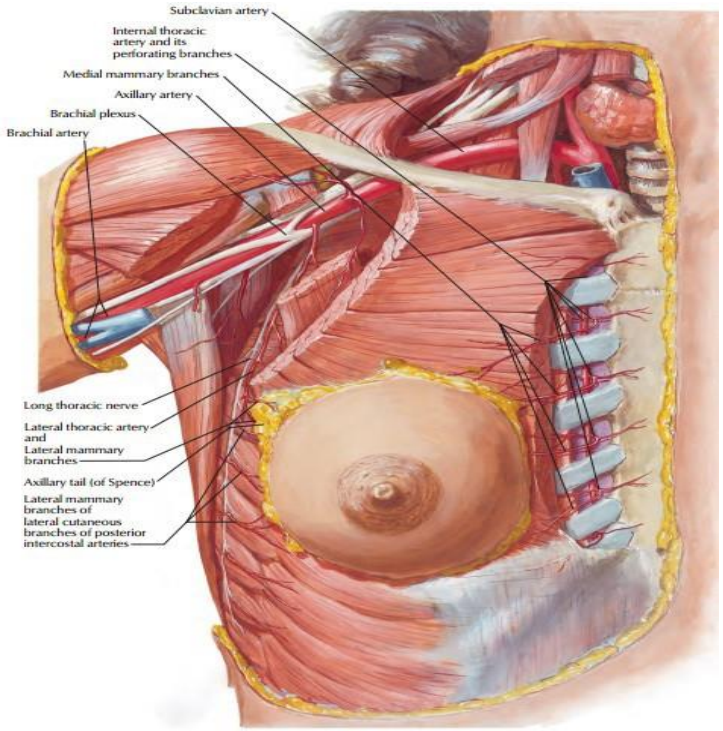
of pulmonary metastases.



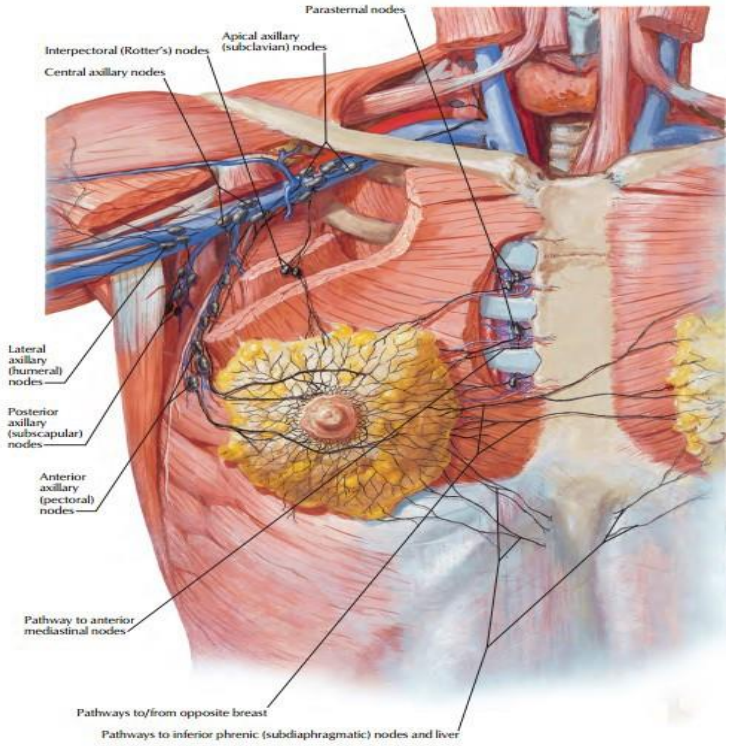
Topography of Breast



Breast – Sagittal View



Blood Supply



Lymphatics

EPIDEMIOLOGY

Worldwide, breast cancer is the most common type of cancer and the most common cause of cancer-related mortality among women. In women, breast cancer accounts for 26% of new cases of cancer and 15% of cancer deaths, second only to lung cancer as a cause of cancer- specific death. Approximately 1% of breast cancers occur in males and 90% are estrogen receptor (ER)-positive. Incidence rates continued to increase until 2002, likely reflecting the increase in use of mammographic screening, but recently have been reported to be declining. Part of that decline may be due to a decrease in the use of postmenopausal hormone replacement therapy. Although incidence rates (all races combined) are substantially higher for women age 50 and older (375.0 per 100,000) compared with women younger than 50 years (42.5 per 100,000), approximately 23% of breast cancers are diagnosed in women younger than 50 years, because those women represent 73% of the female population.

RISK FACTORS

Dietary and Lifestyle Factors:

Observational studies suggested that high-fat diets were associated with higher rates of breast cancer than low-fat diets. However, a meta-analysis of eight prospective epidemiologic studies failed to identify an association between fat intake and breast cancer risk in adult women in developed countries. Consistent with these findings, a randomized dietary modification in 48,835

women in the Women's Health Initiative study did not result in a statistically significant reduction in breast cancer incidence after 8 years of follow-up. Breast cancer risk increases linearly with the amount of alcohol consumed.

Obesity is associated with both an increased risk of breast cancer development in postmenopausal women and increased breast cancer mortality. Women with a body mass index of ≥31.1 have a 2.5-fold greater risk of developing breast cancer than those with a body mass index of ≤22.6.23 Weight and weight gain appear to play an important but complex role in breast cancer risk.

Environmental Factors

Exposure to ionizing radiation increases breast cancer risk, and the increase is particularly marked for exposure at a young age. This pattern has been observed in survivors of the atomic bombings, those undergoing multiple diagnostic X-ray examinations, and in women receiving therapeutic irradiation. A markedly increased risk of breast cancer development has been reported in women who received mantle irradiation for the treatment of Hodgkin lymphoma before age 15 years.

Hormonal Factors

The development of breast cancer in many women appears to be related to female reproductive hormones, particularly endogenous estrogens. Early age at menarche, nulliparity or late age at first full-term pregnancy, and late age at

menopause increase the risk of developing breast cancer. In postmenopausal women, obesity and postmenopausal hormone replacement therapy (HRT), both of which are positively correlated with plasma estrogen levels and plasma estradiol levels, are associated with increased breast cancer risk. Most hormonal risk factors have a relative risk (RR) of ≤ 2 for breast cancer development.

The age-specific incidence of breast cancer increases steeply with age until menopause, and then plateaus. There is substantial evidence that estrogen deprivation via iatrogenic premature menopause can reduce breast cancer risk. Premenopausal women who undergo oophorectomy without hormone replacement have a markedly reduced risk of breast cancer later in life, with an increasing magnitude of risk reduction as the age at oophorectomy decreases. Data from women with BRCA1 and BRCA2 mutations suggest that early oophorectomy has a substantial protective effect on breast cancer risk in this population also. Age at menarche and the establishment of regular ovulatory cycles are strongly linked to breast cancer risk; the total duration of exposure to endogenous estrogens seems important. There appears to be a 20% decrease in breast cancer risk for each year that menarche is delayed. Of note, hormone levels through the reproductive years in women who experience early menarche may be higher than in women who undergo a later menarche. Additionally, late onset of menarche results in a delay in the establishment of regular ovulatory cycles, which may contribute to protective effects. Nulliparous women are at greater risk for the development of breast cancer than parous women, with a RR

of about 1.4. Breastfeeding, particularly for longer duration, lowers the risk of breast cancer diagnosis. The combined effects of reproductive history and breastfeeding may account for substantial fractions of the difference in breast cancer risk between developed and developing nations.

Familial Factors

A family history of breast cancer has long been recognized as a risk factor for the disease, but only 5% to 10% of women who develop breast cancer have a true hereditary predisposition. Overall, the risk of developing breast cancer is increased 1.5-fold to 3 fold if a woman has a mother or sister with breast cancer. Mutations in the breast cancer susceptibility genes BRCA1 and BRCA2 are associated with a significant increase in the risk of breast and ovarian carcinoma, and account for 5% to 10% of all breast cancers. These mutations are inherited in an autosomal dominant fashion and have varying penetrance.

AJCC CLINICAL STAGING:

Primary Tumor (T):

TX Primary tumor cannot be assessed

T0 No evidence of primary tumor

Tis Carcinoma in situ

Tis (DCIS) Ductal carcinoma in situ

Tis (Paget's) Paget's disease of the nipple NOT associated with invasive carcinoma and/or carcinoma in situ (DCIS) in the underlying breast parenchyma.

Carcinomas in the breast parenchyma associated with Paget's disease are categorized based on the size and characteristics of the parenchymal disease, although the presence of Paget's disease should still be noted

T1 Tumor ≤20 mm in greatest dimension

T1mi Tumor ≤1 mm in greatest dimension

T1a Tumor >1 mm but ≤5 mm in greatest dimension

T1b Tumor >5 mm but ≤10 mm in greatest dimension

T1c Tumor >10 mm but ≤20 mm in greatest dimension

T2 Tumor >20 mm but ≤50 mm in greatest dimension

T3 Tumor >50 mm in greatest dimension

T4 Tumor of any size with direct extension to the chest wall and/or to the skin (ulceration or skin nodules).

T4a Extension to the chest wall, not including only pectoralis muscle adherence/invasion

T4b Ulceration and/or ipsilateral satellite nodules and/or edema (including peau d'orange) of the skin, which do not meet the criteria for inflammatory carcinoma

T4c Both T4a and T4b

T4d Inflammatory carcinoma

Regional Lymph Nodes (N):

NX Regional lymph nodes cannot be assessed (e.g., previously removed)

N0 No regional lymph node metastases

N1 Metastases to movable ipsilateral level I, II axillary lymph node(s)

N2 Metastases in ipsilateral level I, II axillary lymph nodes that are clinically fixed or matted; or in clinically detected ipsilateral internal mammary nodes in the absence of clinically evident axillary lymph node metastases

N2a Metastases in ipsilateral level I, II axillary lymph nodes fixed to one another (matted) or to other structures

N2b Metastases only in clinically detected ipsilateral internal mammary nodes and in the absence of clinically evident level I, II axillary lymph node metastases

N3 Metastases in ipsilateral infraclavicular (level III axillary) lymph node(s) with or without level I, II axillary lymph node involvement; or in clinically detected ipsilateral internal mammary lymph node(s) with clinically evident level I, II axillary lymph node metastases; or metastases in ipsilateral supraclavicular lymph node(s) with or without axillary or internal mammary lymph node involvement

N3a Metastases in ipsilateral infraclavicular lymph node(s)

N3b Metastases in ipsilateral internal mammary lymph node(s) and axillary lymph node(s)

N3c Metastases in ipsilateral supraclavicular lymph node(s) Distant Metastases (M):

M0 No clinical or radiographic evidence of distant metastases

cM0(i+) No clinical or radiographic evidence of distant metastases, but deposits of molecularly or microscopically detected tumor cells in circulating blood, bone marrow, or other non- regional nodal tissue that are no larger than 0.2 mm in a patient without symptoms or signs of metastases

M1 Distant detectable metastases as determined by classic clinical and radiographic means and/or histologically proven larger than 0.2 mm

ANATOMIC STAGE/PROGNOSTIC GROUPS:

Stage 0	Tis	N0	M0
Stage IA	T1	N0	M0
Stage IB	T0 T1	N1mi N1mi	M0
Stage IIA	T0 T1 T2	N1 N1 N0	M0
Stage IIB	T2 T3	N1 N0	M0
Stage IIIA	T0 T1 T2	N2 N2 N2	M0

	T3 T3	N1 N2	
Stage IIIB	T4 T4 T4	N0 N1 N2	M0
Sage IIIC	Any T	N3	M0
Sage IV	Any T	Any N	M1

Clinical features of Carcinoma Breast:

Swelling:

History of duration of swelling, its progression whether slowly increasing in size or rapidly increasing has to be asked for. Swellings of short duration are most probably due to carcinoma. But most often, once the swelling is noticed the patient immediately consults a doctor for opinion and so duration may not be clearly obtained. Condition like fibroadenoma and fibroadenosis has got long duration of history. Duration in carcinoma is usually only few weeks. History of swelling in the opposite breast is also important. In 2% of cases, breast carcinomas are bilateral; and so also fibrocystadenosis which commonly has bilateral presentation.

Pain:

Pain in the breast is often termed as mastalgia. It is common in fibrocystadenosis and acute mastitis. There will be associated fever in mastitis. Carcinoma breast is initially painless but eventually becomes painful following infiltration or development of tumour necrosis or skin ulceration/fungation. Pain in fibroadenosis is more prior to menstruation (cyclical), and may disappear during pregnancy and after menopause. Duration of pain, type, timing, site and relation to menstruation has to be noted. Referred pain from muscle and skeletal system (ribs) can also develop in the breast. Periductal mastitis/duct ectasia can cause pain. Patient with breast abscess will show severe excruciating pain in the

breast.

Nipple discharge:

Duration of discharge, its type whether it is of serous /purulent / bloody/ serosanguinous/milky /greenish type has to be asked for and noted. Bloody discharge is often seen in duct papilloma, carcinoma. Serous and greenish discharge is seen in fibroadenosis.

History of changes in nipple:

Like retraction (depression), deviation, destruction, displacement, discolouration, duplication and discharge is noted. Recent history of changes signifies carcinoma. Often retraction may be congenital, since birth.

History of alteration in size and asymmetry of the breasts should be asked for with duration.

History of trauma:

Trauma may cause haematoma in the breast and breast abscess. Direct or indirect trauma often can cause traumatic fat necrosis after few weeks. Here trauma may be forgotten or may not be noticed by the patient and swelling developed due to traumatic fat necrosis is painless, nonprogressive and nonregressive.

History related to swelling in the axilla/neck and their details like duration, progress, pain, ulceration, etc. is noted.

History related to respiratory problems has to be asked like chest

pain/breathlessness/cough/hemoptysis - signifies the secondaries in lung from carcinoma breast.

History of abdominal pain, loss of appetite, decreased weight, jaundice, and abdominal distension should be asked for which signifies liver secondaries.

History related to bone secondaries—like bone pain, low back pain, altered sensation like sense of position and vibration, lower limb weakness, features of paraplegia, loss of control over urination and defecation is asked for.

History of convulsions, loss of consciousness, vomiting, limb weakness, headache, visual disturbances, behavioral changes (psychological changes) and localisation changes may be seen whenever there is brain metastases.

Past History

Past history of any surgeries of breast (recurrence can occur after excision of fibroadenoma, conservative breast surgery may cause recurrent carcinoma breast) or drug therapies like for fibroadenosis. Abscess may recur in congenital retraction of nipple; tuberculosis of breast can show recurrence; fibroadenosis may present repeatedly with long gaps of asymptomatic period. Menstrual History, Obstetric History and Family History

This is important in breast diseases as breast carcinoma can be familial. Family history of carcinoma of breast (in mother, grandmother, aunt, cousins, and 1st and 2nd degree relatives), ovarian tumour or other tumours has to be noted. Often multiple tumours can occur.

History of age of menarche and menopause, menstrual cycles, marital status, number of pregnancies, breastfeeding, last child birth and usage of contraceptives/ postmenopausal HRT are very important. Fibroadenosis and carcinoma are more common in unmarried individuals.

Personal History and Treatment History

History of smoking, alcohol intake, dietary habits (high fat diet) is noted. History of any drug intake at present is important. Examination of Breasts Inspection

For proper inspection, both breasts should be exposed properly including axillae. Inspection is done in sitting position with the arms by the side of the body.

Inspection is also done with the arms raised above the shoulder touching the head (with arms touching the ears) so that nipple levels, lump, dimples are seen well.

Inspection is also done with the arms on the hips pressing and relaxing so that skin dimpling, nipple movements and changes become more prominent. Examination/inspection done in bending forward position helps to see whether breast falls forward or not; and also to see nipple retraction or failure of nipple to fall away. Carcinoma fixed to chest wall will not fall forward while bending forward

Inspect both breasts—note the size, shape and symmetry. Asymmetry can

be seen in breast lumps. Inspect both breasts while leaning forward to see whether both breasts fall forward or not. In carcinoma, if the breast lump gets fixed to underlying chest wall, it will not fall forward. Both breasts should be inspected while the arms are raised upwards to see whether breast is/breasts are adherent to chest wall.

Inspection of nipple

Look for symmetry/asymmetry, pushed up/down, displacement, retraction, size/shape of nipple, discharge/ulceration in the nipple, discoloration, duplication, cracks/fissures. Many of these changes occur in carcinoma. Fissuring and cracks can occur in breastfeeding mothers Nipple retraction of recent onset may be due to infiltration of lactiferous duct by carcinoma.

Often congenital retraction may be present; so duration of nipple retraction is very important. Retraction of nipple can occur in duct ectasia/periductal mastitis also. Nipple retraction is circumferential in carcinoma; slit like in periductal mastitis. Vertical distance from the clavicle and horizontal distance from the midline should be measured and compared to opposite side.

Nipple may be drawn

Towards the lump in the affected breast. Nipple elevation may become prominent by raising the arm above the head; which may be due to inflammatory pathology. In Fibroadenoma, gets displaced away from the lump. Nipple

destruction is seen Paget's disease and fungating/ulcerating carcinoma. Accessory nipple often may be present along the milk line from axilla to groin or in the thigh; which may show milky discharge during lactation. Nipple may become prominent when there is a swelling underneath like cyst/benign tumour/inflammatory oedema. Nipple may be swollen in infection or carcinoma. It is important to note the type of discharge from the nipple – blood, milk, greenish fluid, serosanguinous, purulent. Bloody discharge may be a feature of duct papilloma or carcinoma

Discharges from the nipple:

Blood

- Papilloma – commonest cause
- Ectasia
- Carcinoma – 5% of causes for discharge

Serous

- Fibrocystic disease
- Ectasia

Greenish

- Ectasia
- Fibrocystic disease

Purulent

- Infection
- Sometimes malignancy

Milk

- Lactation (Physiological discharge)
- Galactorrhoea

Serosanguinous

- Carcinoma
- Infection

Inspection of the areola:

Areola should be inspected for any changes in colour, size, ulceration, eczema/ eczema like changes. Both areolas should be inspected. Areola is pink in colour in young girls, dark coloured in adults, brownish during pregnancy and lactation. Ulceration of nipple can occur in carcinoma and Paget's disease of breast, a localised type of carcinoma breast. It should be differentiated from eczema. Eczema is commonly bilateral without any nodule underneath, associated with itching and vesicles, with normal nipple. It is common during lactation. Paget's disease of breast is unilateral, without vesicles and itching, with a hard lump underneath, often with destruction of nipple. Areola may increase in size significantly in soft fibroadenoma or sarcoma; may be shrunken in size in scirrhous carcinoma. In normal individual, areola is slightly

corrugated, with Montgomery's glands on it as small nodules. These glands get hypertrophied during pregnancy and lactation to form Montgomery's tubercles. Retention cyst of this gland presenting as smooth, localised soft fluctuant swelling in the areola is known to occur which often may get infected.

Inspection of the skin over the breast:

Skin over the breast is inspected for retraction, pigmentation, redness/shining, dimpling, puckering, peau d' orange, nodules, ulceration, fungation, and scar. Any dilated veins over the skin and cancer en cuirasse is looked for. Involvement/infiltration of the ligament of Cooper by carcinoma causes dimpling (is a small depression) and puckering (a small fold/wrinkle) of skin over the breast. Normal elastic ligament of Cooper becomes inelastic and shorter in carcinomatous infiltration (Dimpling and puckering are inspectory findings whereas tethering is a palpatory finding). Oedema of skin is due to blockade of cutaneous lymphatics causing burial of sweat glands and hair follicles giving the appearance of orange peel (peau d' orange).

When ulcer is present, its position, size, shape, margin, floor, edge should be noted. Cancer en- cuirasse is extensive involvement of the skin over the breast and chest wall with multiple nodules and ulceration by the carcinoma. It looks like armor coat. Red, oedematous skin is seen in acute mastitis. Dilated veins are commonly observed in cystosarcoma phylloides, large breast abscess, and in carcinoma breast. It is due to blockade of dermal lymphatics. Mondor's

disease is superficial thrombophlebitis of veins over chest wall and breast seen in females. It is painful, tender cord-like lesion which on raising the arm above the shoulder causes puckering of skin adjacent to the dilated vein. It is a self-limiting disease. Nodules are usually due to carcinoma; often it may be metastatic from the underlying carcinoma breast. Ulceration is due to carcinomatous infiltration of skin. In cystosarcoma phylloides and sarcoma, ulceration can occur as a pressure necrosis over the summit. Probing under the ulcer edge is easily possible in these conditions but not in carcinomatous infiltration.Swelling in the breast is an important finding to be inspected. Its location in relation to the quadrants of the breast, extent, size, shape, margin, surface, overlying skin should be examined.

Inspection of the axilla and supraclavicular fossa: Arm should be raised adequately to inspect the axilla. Axilla and supraclavicular fossa should be inspected for any lymph node swelling. Both sides should be inspected.

Inspection of arm and thorax: Oedema of the arm may be due to lymphatic obstruction of axillary nodes by malignant cells spreading from carcinoma breast. Oedema begins from distal to proximal and more prominent distally (brawny oedema). Venous obstruction can also cause oedema arm. Here oedema is more prominent proximally in the arm and is having bluish discolouration over the skin. It is commonly due to infiltration and often by compression of lymph nodal metastatic disease onto the axillary vein. It needs urgent radiotherapy to axilla or chemotherapy otherwise venous gangrene of

upper limb may develop. Arm oedema may be seen after mastectomy also. Multiple nodules with skin thickening over the arm and chest wall due to carcinomatous infiltration is called as ‘cancer en cuirasse’as it looks like armor coat. Palpation Normal breast tissue is firm, lobulated with fine nodularity. Often it can be soft and smooth also. Palpation is also done between thumb and fingers. All quadrants should be palpated along with nipple areola complex and axillary tail of Spence.

During palpation one should look for raise in temperature over the breast (observed in mastitis but also can occur in vascular tumours like medullary carcinoma and sarcoma), tenderness, nature of the swelling—its size, shape, extent, surface, margin, consistency (carcinoma is hard/stony hard and irregular), fixity to breast tissue (swelling will not have independent/differential mobility), fixity to skin (by pinching the skin), fixity to pectoral fascia (by tethering), fixity to pectoralis major muscle/serratus anterior muscle/latissimus dorsi muscle. Palpate ulcer if present—look for tenderness, its edge and base for induration, bleeding on palpation. Nipple and areola should be palpated for tenderness, eversion, induration and discharge.

Local rise of temperature: It is checked with dorsum of fingers. Breast is warm in mastitis and so also sarcomas can be warmer. Aggressive carcinoma also can be warm due to increased vascularity.

Tenderness: Breast is tender to palpate in acute mastitis and abscess.

Carcinoma is non tender initially but becomes tender once skin is involved or when chest wall infiltration occurs. Number, size and shape: Carcinoma of breast is solitary; fibroadenosis can be multiple. Fibroadenoma is usually solitary but multiple fibroadenomas are known to occur occupying entire breast tissue. Opposite breast also can be involved especially in fibroadenosis. Size is important in staging the (T staging) carcinoma breast and so it should be measured using a tape (in cm).

Margin: Margin is well-defined and regular in fibroadenoma; well-defined and irregular in carcinoma; ill-defined in fibroadenosis.

Surface: It may be nodular or granular or uneven in carcinoma. Smooth surface is seen in benign condition like fibroadenoma.

Consistency: Fibroadenoma is firm swelling; carcinoma is stony hard; fibroadenosis is firm or diffuse India rubber consistency. Sarcoma is variable with soft or firm or hard in texture. Fluctuation: When swelling is soft, fluctuation test is done. It is done by examiner standing or sitting behind the patient. Two hands of the examiner are placed above the shoulders of the patient. Swelling is held with one hand and with index finger of the other hand summit of the swelling is pressed/indented. Fluid displacement can be appreciated with yielding of the finger. Cystic swelling, localised abscess can be fluctuant.

Fixity of the lump to breast tissue: It is checked by holding the breast tissue in one hand and moving the lump in other hand. If lump is fixed to breast

tissue, then breast tissue moves along the lump. Carcinoma breast is fixed to breast tissue. Fibroadenoma shows free mobility (differential mobility) within the breast tissue and so is called as 'breast mouse'. Skin tethering can be demonstrated by moving the lump one side. It is due to inward puckering of the skin following involvement of the elastic Cooper's ligament which becomes inelastic. Dimpling of skin appears which can be demonstrated by raising the arms above the shoulder level. When skin tethering occurs lump can be moved in the arc anywhere without moving the overlying skin whereas lump cannot be moved at all without moving the skin in skin fixation.

Fixity to skin: When tumour directly infiltrates the skin, fixity occurs. Here skin will not be moved separately over the lump. Skin thickening and hard nodules are felt. Peau d' orange can be better seen by holding the skin between thumb and fingers. Whether benign or malignant, when tumour lies beneath the nipple, it is fixed to it. But tumour beneath the areola may or may not be fixed to it as it depends on presence or absence of infiltration to areola.

Fixity to pectoralis major muscle: It is checked in sitting position. Patient is asked to keep her hands on her waist. Lump is moved along the direction of the muscle and also perpendicular to the direction of the muscle. Patient is asked to hold the hands tightly pressed over the waist to contract the pectoralis major muscle (action of the muscle is flexion of the shoulder) which is confirmed by feeling the taut muscle. Lump is again moved along the direction and perpendicular to the direction of the muscle. Mobility along the line of

muscle fibers will be restricted totally if lump is adherent to the pectoralis major muscle. It becomes T3 stage tumour.

Fixity to latissimus dorsi muscle: It is checked in sitting position with examiner standing by the side of the patient. Latissimus dorsi is an extensor of the shoulder joint. Initially mobility of the lump is checked and then arm is extended against resistance with elbow flexed 90° to contract the latissimus dorsi. If now mobility of the lump is restricted, it confirms that lump is fixed to latissimus dorsi muscle

Fixity to serratus anterior muscle: It is checked by checking the mobility of the lump before and after contracting the serratus anterior. Contraction of serratus anterior is achieved by pushing both the outstretched hands against resistance over the wall or over the examiner's shoulders and checking for restriction of mobility of the lump. It signifies involvement of chest wall—stage T4.

Chest wall fixity: It can be assessed by absence/ presence of mobility of the mass; and breast with mass will not fall forward if it is fixed to underlying chest wall; and on raising the arm above shoulder breast with mass will not raise upward. Chest wall fixity means fixity to ribs and intercostal muscles.

Palpation of nipple: It is equally important to palpate the nipple. Tenderness, thickening, hardness, mobility should be checked. Tumour underneath nipple is usually fixed to nipple.

Retraction of nipple may be confirmed by palpating it. Discharge can be better appreciated while palpating the lump in the breast or other part of breast tissue or nipple itself. Colour, content (serous, blood, pus, greenish milk) of the discharge can be found. Discharge should be collected for cytology or culture or AFB staining. In retracted nipple, gentle pressing of the base of the nipple is done to evert it. If it is due to congenital or of benign cause, retracted nipple can be everted by pressing at the base. If retraction is due to carcinoma, it cannot be everted at all. Retraction is circumferential in carcinoma; slit like in duct ectasia.

Palpation of areola: Areola should be palpated for nodularity, thickening, ulcer, destruction. Paget's disease can cause destruction of areola.

Examination of an ulcer over breast: Ulcer if present over the breast lump, should be examined like any ulcer with inspection of floor, margin, edge, discharge; palpation for tenderness, induration, mobility, fixity.

Examination of ipsilateral, regional axillary lymph nodes. Anterior/pectoral, central/medial, posterior, lateral, apical lymph nodes should be examined.

Supraclavicular lymph nodes should be examined.

Examination of opposite breast opposite axilla:

Opposite axillary nodes are also examined. It may get involved through retrograde spread from internal mammary nodes or through cutaneous lymphatics.

Palpation of Axillary Lymph Nodes

Anterior/pectoral group of nodes are commonly involved nodes. Patient will be in sitting position. Raise the patient's arm high and inspect the axilla. Place the patient's forearm over examiner's forearm. Palpate the relaxed axilla over pectoralis major muscle for any lymph nodes. Examiner will use his left hand to examine the nodes (of right axilla) and his right hand will be over patient's left shoulder to support.

Interpectoral nodes (Rotter's) are also palpated similarly by insinuating the fingers between the two pectori. It signifies retrograde spread of the tumour. It is often difficult to palpate. Central/medial group of nodes are palpated in similar way like pectoral nodes but hand in the axilla is directed medially over the lateral chest wall and with gentle rolling movements using pulp of the finger.

Lateral/humeral group of nodes are palpated with examiner's right hand (for right axilla) with left hand placed over same side shoulder.

Posterior/subscapular nodes are palpated with patient in sitting position and examiner standing behind the patient. By raising the arm and forearm of the patient from opposite side the posterior axillary fold is palpated between thumb and fingers.

Apical nodes are palpated (for right axilla) with left hand of the examiner placing high in the axilla with right hand supporting over the shoulder and supraclavicular region of the same side of the axilla. It is often difficult to palpate.

Supraclavicular nodes are palpated using fingers over supraclavicular fossa by standing behind the patient who is asked to shrug the shoulder.

Axillary nodes on opposite side are also examined.

Opposite axilla can be examined by examiner standing on the same side by leaning over the patient or can be examined by standing on the opposite side. Its involvement signifies stage IV disease.

Levels of the axillary nodes (Berg's levels):

Level I-Below and lateral to the pectoralis minor muscle-anterior, lateral, posterior Level II-Behind the pectoralis minor muscle-central Level III-Above and medial to pectoralis minor muscle-apical Axillary tail of the Spence: It is the extension of the upper outer quadrant of breast across foramen Langer deep to deep fascia. Foramen Langer is an opening in deep fascia over outer aspect of the breast which allows part of breast tissue to extend under deep fascia. Axillary tail is located adjacent to outer border of the pectoralis major muscle. When it is involved by carcinoma it should be differentiated by pectoral node enlargement. Axillary tail will move along with main breast tissue whereas pectoral node will not move when breast is moved as it has got independent mobility. Axillary tail often extends over the lateral edge of the pectoralis major muscle up to axilla.

Examination of arms for venous oedema or lymphoedema

Venous oedema may be due to axillary vein compression by nodal mass. Lymphoedema may be due to lymphatic block following nodal involvement.

Lymphoedema is mainly distal. It is gradual in onset and progressive. Venous oedema is sudden in onset, with bluish discolouration over the skin, uniform in both distal and proximal aspect of the upper limb (forearm and arm).

Examination for mediastinal node involvement: It is done by percussion. Initially percus for liver dullness. Percussion is done one space above from lateral to medial, to look for widened mediastinal border. Mediastinal nodes are common in middle mediastinum.

Examination of respiratory system: It is done for secondaries-altered breath sounds, features of consolidation or pleural effusion are looked for.

Examination of abdomen: To look for palpable nodular liver, Krukenberg tumours in ovaries in menstruating age group, and ascites. It is completed with digital examination of rectum (P/R), and per vaginal examination.

Examination of pelvis, spine, long bones for any swelling/tenderness/pathological fracture/restricted movements of spine, hips, etc.

Examination of central nervous system to look for any neurological deficits following metastatic disease in the brain

DIAGNOSIS:

The presence or absence of carcinoma in a suspicious clinically or

mammographically detected abnormality can only be reliably determined by tissue biopsy. An abnormal MRI does not reliably indicate the presence of cancer, and a non-worrisome MRI does not reliably exclude carcinoma. Available biopsy techniques include fine needle aspiration (FNA), core needle biopsy, and excisional biopsy. Needle biopsy techniques (FNA or core biopsy) are preferred because they are more cost-effective than surgical excision, and because most breast lesions are benign, they avoid a surgical scar and potential cosmetic deformity. FNA is easily performed, but requires a trained cytopathologist for accurate specimen interpretation and does not reliably distinguish invasive cancer from DCIS, a particular drawback for non-palpable abnormalities, which are often DCIS. Core-cutting needle biopsy has many of the advantages of FNA, but provides a histologic specimen suitable for interpretation by any pathologist, and facilitates ER, PR, and HER2 testing.

Modified Radical Mastectomy: PROCEDURE

Skin Incision:

Elliptical Classical Stewart incision with skin margins of 1 to 2 cm from the gross margin of the index tumor

Limits of Dissection:

Limits of the modified radical procedure are as follows:

- Delineated laterally by the anterior margin of the latissimus dorsi muscle,

- Delineated medially by the sterno–caudal junction border,
- Delineated superiorly by the subclavius muscle, and
- Delineated inferiorly by the caudal extension of the breast to approximately 2 to 3 cm below the inframammary fold

Skin flaps are raised sharply with a scalpel, extending superiorly to the clavicle, medially to the lateral border of the sternum, inferiorly to the superior aspect of the rectus sheath, and laterally to the latissimus dorsi muscle. The pectoralis major fascia is incised, controlling internal mammary perforators (medially) with ties. The breast and pectoralis fascia are excised with knife or cautery. The breast is left attached inferolaterally to provide traction. The latissimus dorsi muscle edge is followed superiorly along its anterior surface using Richter scissors. Care is taken to preserve the intercostobrachial nerves as encountered. As the muscle becomes tendinous, the axillary vein will be encountered crossing superior to it. The axillary vein is cleared on its anterior surface in a layer-by-layer, lateral-to-medial fashion from the latissimus muscle to the chest wall, taking care not to strip the vein. Dissection is then continued along the axillary vein about 5 mm inferior to the vein, again in a layer-by-layer, lateral-to-medial fashion from the latissimus muscle to the chest wall. Long thoracic nerve and Thoracodorsal bundle are preserved. The remainder of the specimen is removed by electrocautery where it remains attached inferolaterally, doing so in such a way that the breast and axillary portions of the specimen

remain intact.

AXILLARY REVERSE MAPPING :

In study group,after completion of simple mastectomy and 5 to 10 minutes before Axillary lymphnode dissection, 2.5 ml of methylene blue dye is injected intra-dermally and subcutaneously in the upper inner arm along the medial intramuscular groove of the ipsilateral side. The upper inner area is chosen simply because it has the most rapid drainage and it hides the tattoo that could last from 1 week to 6 months. After injection, the site is massaged and the arm is to be elevated for 5 minutes to enhance arm lymphatic drainage.

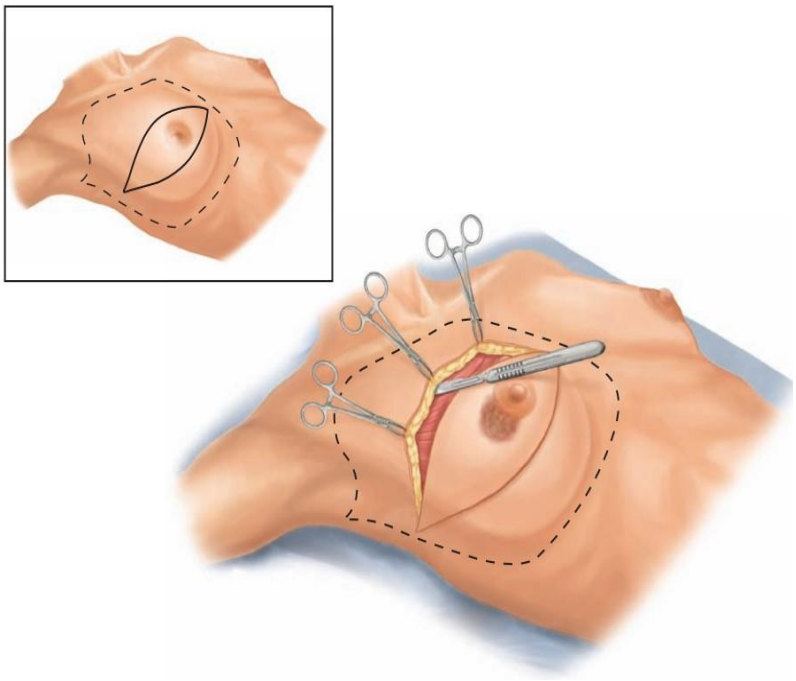
Axillary dissection in the study group is done from the lateral side first to detect and preserve the mapped lymphatic channels. Entrance of the axilla in the control group is done as usual from medial to lateral. After dissection through the axillary fascia, we could identify and preserve the apparent blue lymphatics draining the arm and ligation of the injured ones .The unstained lymph nodes were removed and sent for histopathological examination.

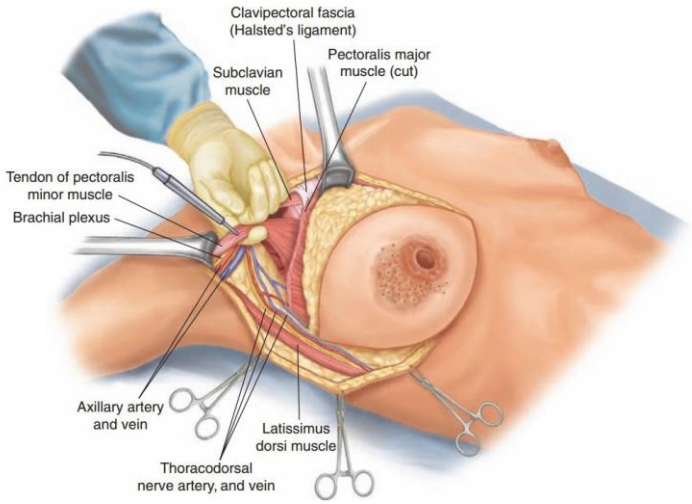
Wound closure

Two Closed-suction silastic catheters (14 French) are placed and secured with separate 2-0 silk sutures. The wound is closed in two layers, first with absorbable 2-0 Vicryl suture to approximate the subcutaneous tissues and 2-0 Ethilon sutures for skin closure.

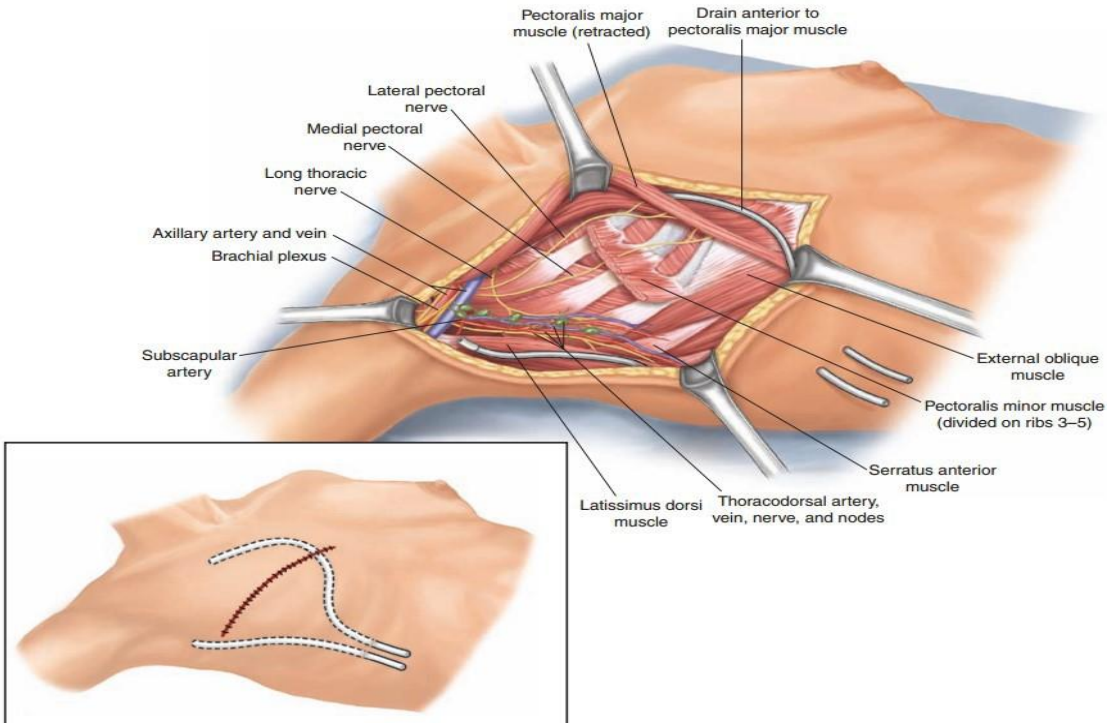
Post operative Course:

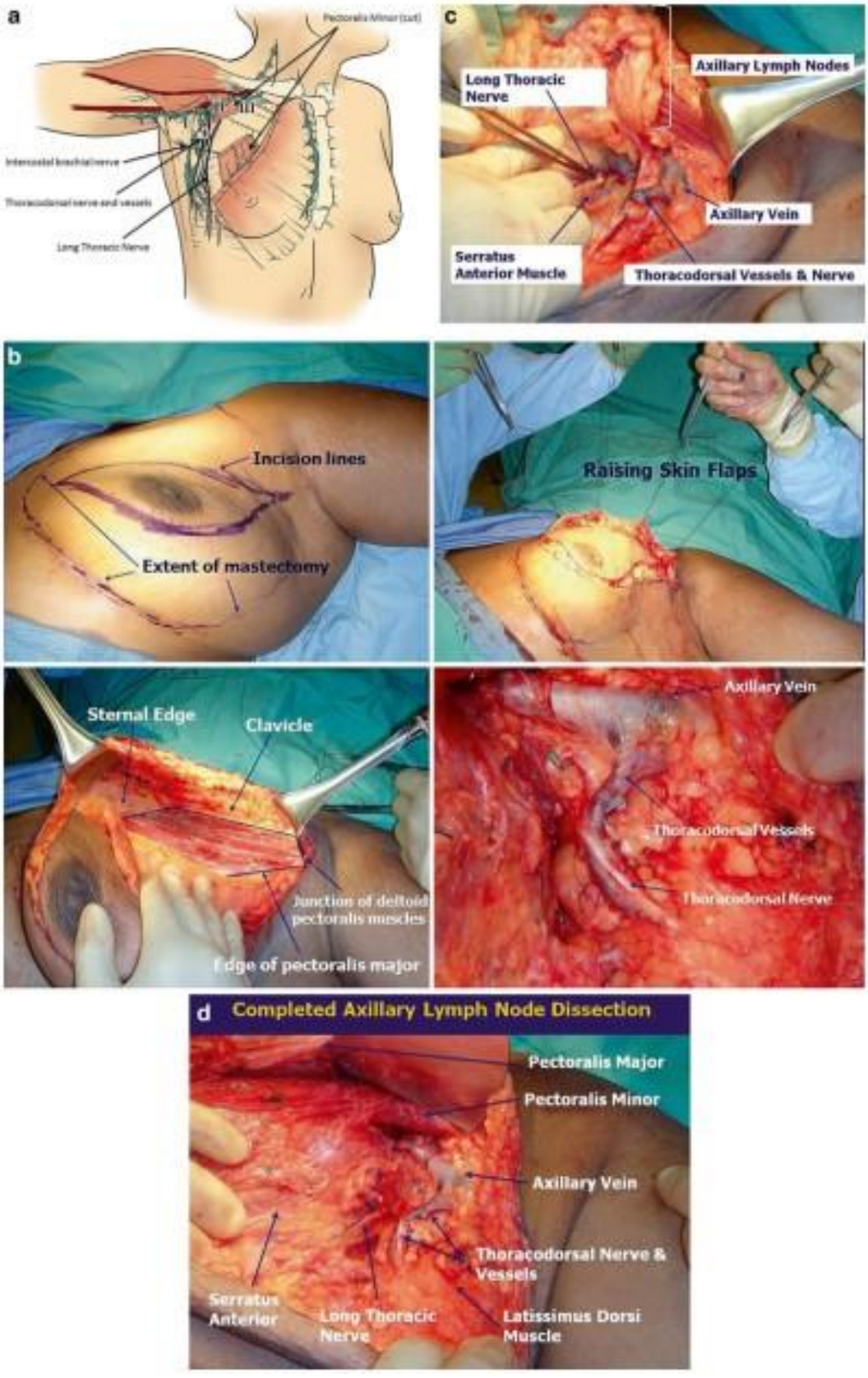
Tape measurement of the arm circumference 10cm above and below olecranon process was used to detect lymphoedema. This was done preoperatively and 2 weeks, 1 and 2 months postoperatively in both study and control groups.



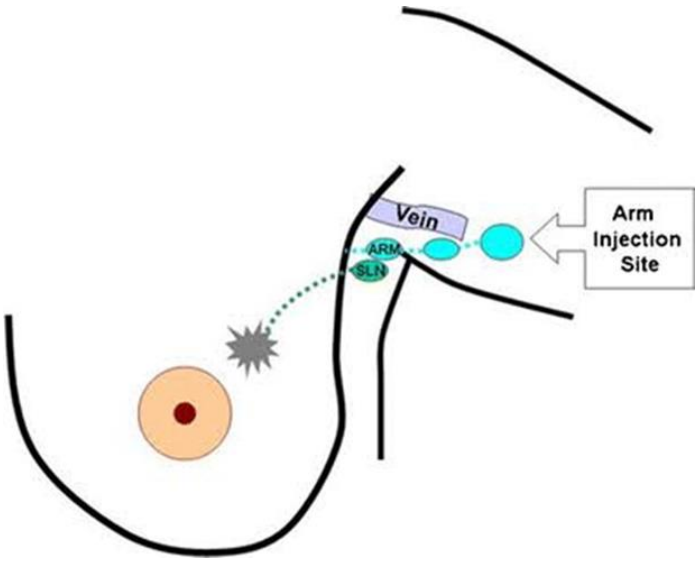


Axillary Dissection in Patey's Modified Radical Mastectomy



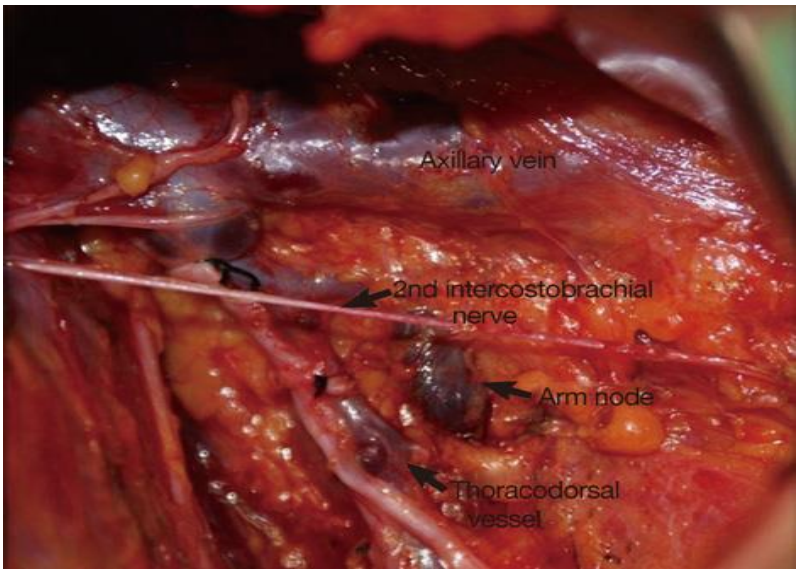

a
Pectoralis Minor (cut)
Intercostal brachial nerve
Thoracodorsal nerve and vessels
Long Thoracic Nerve
c
Long Thoracic Nerve
Axillary Lymph Nodes
Axillary Vein
Serratus Anterior Muscle
Thoracodorsal Vessels & Nerve
b
Incision lines
Extent of mastectomy
Raising Skin Flaps
Sternal Edge
Clavicle
Junction of deltoid pectoralis muscles
Edge of pectoralis major
Axillary Vein
Thoracodorsal Vessels
Thoracodorsal Nerve
d
Completed Axillary Lymph Node Dissection
Pectoralis Major
Pectoralis Minor
Axillary Vein
Thoracodorsal Nerve & Vessels
Serratus Anterior
Long Thoracic Nerve
Latissimus Dorsi Muscle

TECHNIQUE OF AXILLARY REVERSE MAPPING



INJECTING DYE OVER THE INNER ASPECT OF ARM

BLUE STAINED LYMPH NODE NOTED DURING AXILLARY DISSECTION



COMPLICATIONS:

Lymphedema- The incidence of functionally significant lymphedema after a modified radical mastectomy is about 10-50%. Extended axillary lymph node dissection, adjuvant radiation therapy, the presence of pathological lymph nodes, and obesity contribute to an increased incidence. When necessary, individually fitted compressive sleeves and intermittent compression devices can reduce the extent of lymphedema and palliate symptoms.

Seroma - Development of a seroma beneath the skin flaps or in the axilla represents the most frequent complication of mastectomy and axillary lymph node dissection.

Wound infections - occur infrequently after a mastectomy and the majority occurs secondary to skin flap necrosis. Culture of the infected wound for aerobic and anaerobic organisms, debridement, and antibiotics are effective management.

Hemorrhage- Moderate or severe hemorrhage in the postoperative period is rare and is best managed by return to the operating room with early wound exploration for control of hemorrhage and reestablishment of closed system suction drainage.

Nerve Injury**:**

Intercostobrachial Nerve- circumscribed numbness of the medial aspect of the ipsilateral upper arm occurs.

Long thoracic Nerve- winged scapula deformity occurs.

Medial and Lateral pectoral Nerves- Pectoralis muscles atrophy occurs.

Thoraco dorsal Nerve- Internal rotation and abduction of the shoulder will be weakened.

LYMPHEDEMA

Lymphedema of the upper arm is a non-lethal complication of axillary lymph node dissection. The incidence of lymphedema is variable (from 10-50%) according to difference of the treatment modalities (Sentinel L.N or axillary lymph node dissection) with or without radiotherapy. Because of its chronicity it is considered one of the most dreaded morbidities

PATHOPHYSIOLOGY

Lymphoedema is defined as an increase in arm volume greater than 20% from baseline following axillary dissection.

It results from cutting or ligation of upper limb lymphatics during axillary dissection.

The virtually unknown variations in arm lymphatic drainage put the arm lymphatics at risk for disruption during ALND. Therefore, mapping the drainage of the arm with blue dye and preserving the identified lymphatics would help in identification and decrease the likelihood of disruption of the lymphatics draining the arm during ALND.

FACTORS RELATED TO SURGERY

Techniques

Surgical treatment for breast cancer has undergone a paradigm shift from Halstead's radical mastectomy to breast conservation. It has been demonstrated that radical mastectomy with axillary dissection increases lymphedema formation compared with that of simple mastectomy . The number of removed lymph nodes influence lymphedema formation . A randomized controlled trial by Purushotham et al. demonstrated that sentinel lymph node biopsy is associated with significantly less seroma formation than that of conventional axillary dissection .

Sentinal Lymph Node Biopsy:

The technique of axillary lymph node dissection (ALND), supplanted by sentinel lymph node(SLN) for the majority of patients, has changed little since its inception, being purely an anatomic dissection. Although SLN clearly reflects the status of the axillary lymph node basin and is less morbid, it has not prevented lymphedema. There can be no doubt that lymphedema is minimized with SLN in comparison with ALND, as seen in eight clinical trials comparing the two. Rates of lymphedema with SLN were much lower than those with ALND, in the range of 0% to 13%, compared with 7% to 77% for ALND. Several cooperative group trials have shown lymphedema rates in approximately the 7% range with SLN biopsy alone. We hypothesized that this

higher than expected rate of lymphedema may be secondary to disruption of low-lying arm lymphatics during a sentinel lymph node biopsy (SLNB) procedure.

Liposuction:

Surgical debulking of the affected extremity using liposuction has been shown to be very effective at reducing the volume to near normal. It has been reported that liposuction technique provides long standing reduction in extremity size as compared to the normal side . This technique requires patient compliance with compression therapy to prevent regression. Patients considering this technique should undergo pre-operative conservative management with no pitting edema . It is known that adipose tissue functions as a crucial organ and a cytokine-activated cell in LE . The removal of adipose tissue using liposuction does not affect the already decreased lymph transport system in LE . Moreover, a significant improvement was detected in skin blood flow and quality of life after liposuction. Its complications include infection, skin necrosis and recurrence.

Non-Surgical Treatments

Patient education is both crucial and mandatory . Self-care and risk-reductive practices, self-lymph drainage, skin care, proper alignment of bandages and garments, good nutrition, exercise and weight control are the basics prior to LE treatment .

Complete Decongestive Therapy

Complete Decongestive Therapy (CDT) is includes two phases: reductive (phase 1) and maintenance (phase 2) . CDT is a good option in decreasing LE volume and includes manual lymph drainage, compression therapy, physical exercise, skin care as self-management, followed by wearing compression garments . Although it is safe and effective in most patients, it is expensive, time-consuming and needs certified therapists. In addition, patient compliance to long-term CDT is challenging. Nevertheless, CDT can be individualized with modifications until the lymphedematous volume reduction has been maximized.

Manual lymph drainage (MLD):

MLD is a hands-on technique and differs from standard massage by orienting the lymphedematous fluid to proper functioning lymphatics .

Compression Therapy:

Compression therapy includes effective gradient compression with tubular bandaging on the affected limb . Short-stretch bandages provide low “resting pressure” when the patient is at rest and “working pressure” which allows muscle contractions to direct interstitial fluid flow . These bandages also reduce fibrosis in the skin. Compression garments are different from compression bandages and are preferred in long-term treatment.

Exercise:

Specific exercise is beneficial for LE patients . It is recommended that compression bandages or garments should be worn during activity . Patients with LE or people at-risk for LE are encouraged to exercise. A meta-analysis showed that active exercising reduces edema volume in BCRL . A recent pilot study demonstrated that yoga has beneficial effects on an individuals' posture and strength .

Compression Garments:

Initial control of LE can be achieved with the use of compression bandages. Long term control is obtained with compression garments . Patients should have several garments to alternate and ensure the proper pressure and hygienic control. Accurate fitted garments are essential. Some patients require additional coverage night-or-day to control or reduce LE .

Advanced New Generation Pneumatic Compression Therapy:

Advanced Pneumatic Compression (APC) therapy can be used as an adjunct to CDT either in early or late phases . It mimics the pump effect of muscular contraction on lymphatic system . Ranging between 35 and 180 mm-Hg, pump pressures are adjusted to mostly 20-60 mm-Hg . The pressure must be individualized in order to prevent skin damage during application. APC therapy was found beneficial in reducing LE, whereas compression sleeves prevented additional swelling without influencing volume reduction .

Laser Therapy:

A number of randomized trials have reported that Low-Level Laser Therapy (LLLT) improved measurable physical parameters as well as subjective pain scores . LLLT increases lymphatic drainage by stimulating the formation of new lymph vessels, by improving lymphatic motricity, and by preventing formation of fibrotic tissue . Usually, LLLT is used in combination with CDT. Most studies did not report any adverse events to participants, although one study stated development of cellulitis in LLLT patients as an adverse event . Its causal relationship to LLLT was unknown.

Visualisation Techniques in Axillary Reverse Mapping procedure:

Blue Dye :

The initial studies on ARM in 2007 used a blue dye to map axillary upper extremity lymph nodes and lymphatics. In accordance with the initial reports on ARM in 2007 by Nos and Thompson, respectively, blue dye has been used most often to map the axillary upper extremity lymph drainage .Visualisation rates in the axilla of ARM lymph nodes during ALND ranged from 39 to 90 % and of ARM lymphatics from 47 to 86 % .The wide range of visualisation rates (20–90 %) may possibly be explained by several factors. First, the possibility of encountering upper extremity lymphatics or corresponding nodes is dependent on the extent of axillary surgery.Using the

anatomic classification of Clough et al., ARM lymph nodes are most commonly found in the upper outer quadrant of the axilla just caudal of the axillary vein and lateral from the ascending lateral thoracic vein that ends in the axillary vein. Technical aspects of the ARM procedure are a possible third factor that might explain the difference in visualization rates. The time interval between injection of the blue dye and the start of the operation and insufficient intraoperative massage time of the injection spot following injection of blue dye could possibly influence the success rate of the procedure.Finally, the experience of the surgeon in performing the ARM procedure may have an impact on the success rate. It has been suggested that the learning curve is similar to the SLNB procedure and an increase in the detection rates of ARM lymph nodes using blue dye is noted with increasing surgical exposure.

Complications and technical considerations :

Complications due to blue dye are uncommon; reports of anaphylactic reactions , local skin reactions and a transient drop in saturation are rare. Subcutaneous injection of blue dye leaves a ‘blue tattoo’ at the injection site that will disappear after a period of several weeks to more than a year.

Radioisotopes (Tc-99) :

The first study concerning the ARM procedure using a radioisotope was published in 2008 by Nos et al. . In this study, a dual tracer technique using

blue dye to visualise ARM lymphatics and Tc-99 to identify ARM lymph nodes resulted in visualisation rates of in 91 % of all patients. Similar results with Tc-99 (with or without blue dye) have been reported by others. However, the ARM procedure using only Tc-99 cannot be carried out simultaneously with the dual tracer SLN technique in which Tc-99 is also used. Apart from the longer duration of the surgery, a major limitation of the use of Tc-99 is the impossibility of mapping the ARM lymphatics, which also have to be preserved in order to perform a complete ARM procedure .

Fluorescent dye :

Up until now, only five studies have reported on the use of a fluorescent dye (indocyanine green) . In a pilot study reported by Noguchi et al. in 2010, visualisation rates of the ARM lymph nodes and the ARM lymphatics in the ALND field were 88 and 63 %,respectively . A major advantage of using indocyanine green compared to other techniques is the possibility of combining the ARM procedure with standard dual tracer SLNB. Furthermore, no systemic allergic reactions have been reported and the ‘green tattoo’ disappears somewhat quicker compared to the blue dye (within days up to a few months) In conclusion, three visualisation techniques have been used when performing ARM. If upper extremity lymphedema is caused by disruption of the ARM nodes and/or removal of the ARM lymph lymphatics, there will be no place for mapping the axilla using only Tc-99. Visualisation

using blue dye might be preferred since it is easy to perform and inexpensive. However, when using the blue dye technique, a ‘blue tattoo’ will be seen on the patient’s skin following subcutaneous injection. Visualisation using Tc-99 may have higher identification rates when compared to blue dye but does not allow visualisation of the ARM lymphatics, which is considered essential when lymphatic drainage of the upper extremity should be kept intact. Visualisation using fluorescence dyes results in high visualization of both ARM lymph nodes and lymphatics of up to around 90 %. Studies on the former are scarce, however. Moreover, this technique requires the use of additional equipment in contrast to the use of blue dye, which is available in almost every hospital.

Lymphedema Assessment Methods :

Circumferential (>2 cm) and/or volume (>200 mL) differences between the affected and non-affected extremity can be performed . Volume can be measured by tape, water displacement or perometry (Perometer; Perosystems, Wuppertal, Germany) .

Tape measurements require formula calculations; therefore, it is recommended that the measurements should be performed by the same person at defined intervals . In the American College of Surgeons Oncology Group Z0010 prospective observational study, lymphedema is defined as a change in arm circumference of >2 cm when compared with the contralateral or control arm and with baseline measurements.

Water displacement is an accurate method that is the gold-standard for volume assessment. Briefly, a mark was placed 10 cm proximal from the lateral epicondyle. The arm was then inserted into a cylinder filled with water up to the mark on the arm. The water displacement was recorded at baseline and every 6 months over a 4-year follow-up period. The arm volume of the contralateral arm was similarly measured as a control for weight gain or loss. The arm volume increase was obtained by subtracting the volume change on the contralateral side from the volume change on the affected side using the formula [(affected current volume – affected baseline volume) / (affected baseline volume) × 100] − [(contralateral current volume – contralateral baseline volume) / (contralateral baseline volume) × 100]. This protocol is based on the same protocol used for the NSABP B 32 Protocol for arm volume measurements.Based on the consensus document of the International Society of Lymphology, an arm volume increase of the affected side over the opposite side of 20% or more was considered lymphedema however, it is not used in daily practice.

Perometry is a computer-based study that calculates the volume of the affected limb via infra-red optical electronic scanner and can demonstrate small changes, but is expensive.

METHODOLOGY

SOURCE OF DATA

This is a prospective study comprising 60 patients of carcinoma breast over a period of September 2018 to September 2019. In this present study, the clinical material consists of patients admitted with carcinoma breast in the Department of General Surgery, at Government Rajaji Hospital, Madurai.

METHOD OF COLLECTION OF DATA

Sample size

The size of sample work is 60 cases. Patients in study group underwent Modified Radical Mastectomy with axillary reverse mapping(Group A)

Patients in control group underwent Modified Radical Mastectomy without axillary reverse mapping(Group B)

Inclusion criteria

All the patients admitted in general surgical ward, aged more than 18 years with carcinoma breast requiring modified radical mastectomy. Patients consented for inclusion in the study according to the designated proforma.

Exclusion criteria

- Allergy to methylene blue dye
- Prior surgery in ipsilateral axilla

- Prior axillary Radiotherapy
- H/o of primary lymphedema
- Extensive axillary LN metastasis
- Pregnant/Breastfeeding women

The data will be collected in prescribed PROFORMA where in it contains, particulars of the patient, clinical history, clinical examination and diagnosis, relevant investigations, and details of surgery.

Ethical clearance has been obtained from ethical committee of Government Rajaji Hospital, Madurai, prior to conducting the study.

Statistical analysis

In this study, the results of the two groups were compared and analyzed by using Chi-square test.

RESULTS AND OBSERVATION

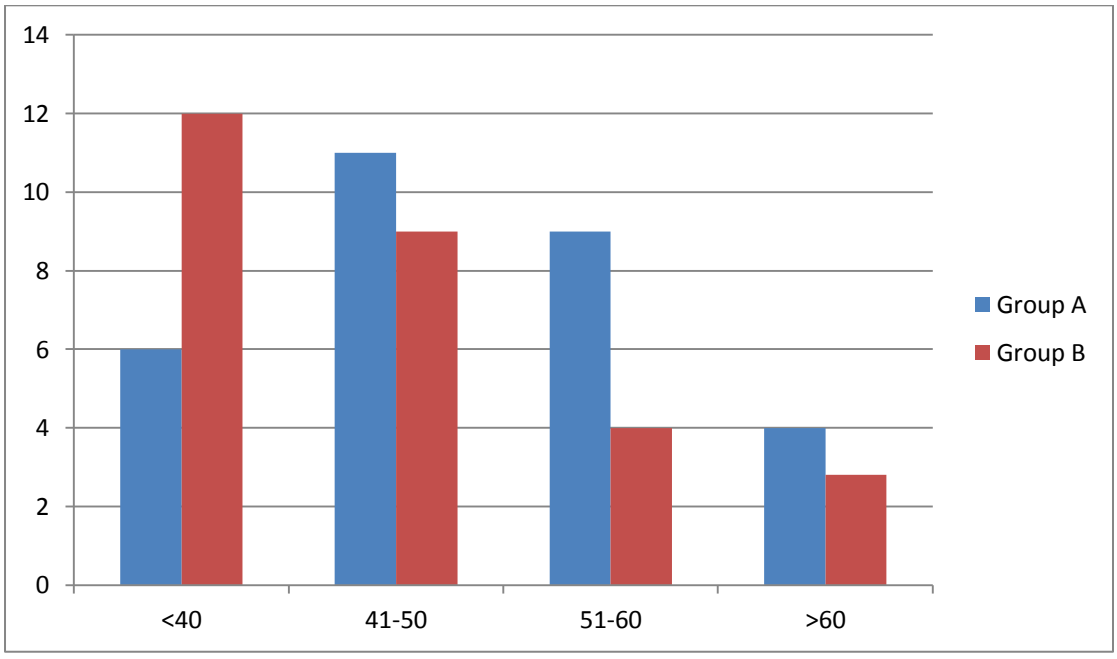
In this “Prospective study of comparing axillary lymphnodes using axillary reverse mapping during modified radical mastectomy” conducted in Department of General Surgery at Government Rajaji Hospital, Madurai from September 2018 to September 2019, a total of 60 patients of Carcinoma Breast who underwent Modified Radical Mastectomy were included in this prospective study, and randomized into two groups based on in-patient number. 30 patients who undergone MRM with Axillary reverse mapping (Group A) and 30 patients who undergone MRM without Axillary reverse mapping (Group B) were considered for the study.

PATIENTS DEMOGRAPHY

Table – 1. Age at Presentation

Age group (in years)	No of Patients	Percentage (%)	Group A (%) n=30	Group B (%) n=30
≤40	18	30	6(20)	12 (40)
41-50	20	33	11 (37)	9 (30)
51-60	13	22	9(30)	4(13)
>60	9	15	4 (13)	5 (17)

Graph - 1 Age at Presentation



In this study, age of the patients were more than 18 years. Around 30% patients were in <40 yrs age group,33% of the patients were in 41-50 age group,22% patients in 51-60 age group.

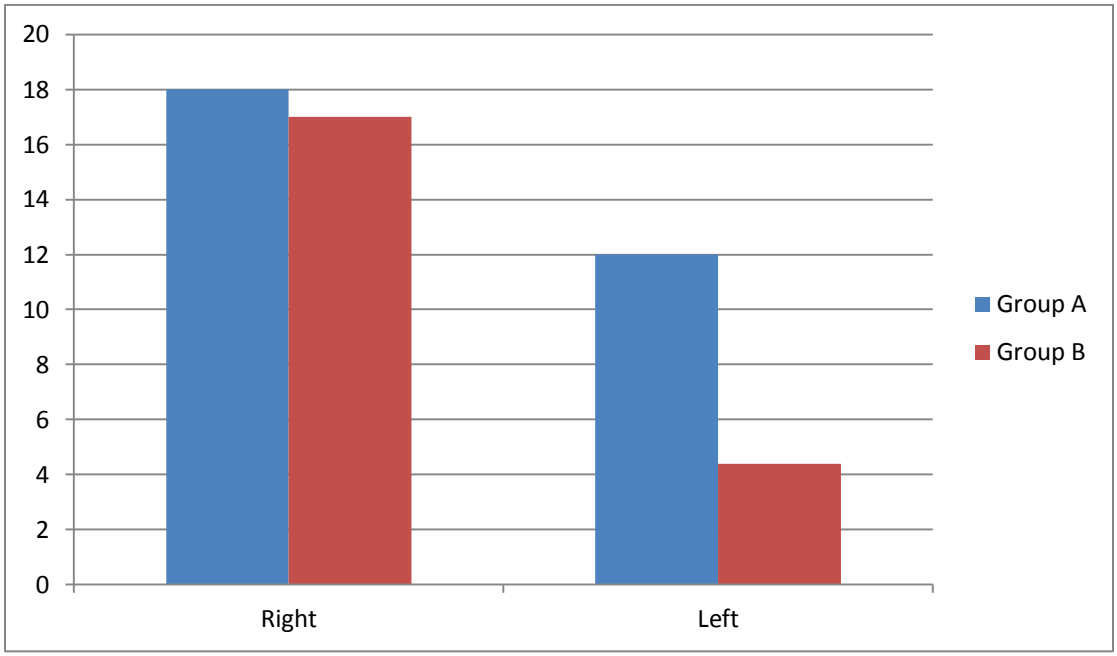
LOCATION OF THE TUMOR

Table – 2. Location of the Tumor

Side	No of Patients		Percentage %
	Group A	Group B	
Right	18	17	58
Left	12	13	42

The present study showed that carcinoma affects both side breast equally, with slight preponderance for right side.

Graph – 2. Location of Tumor



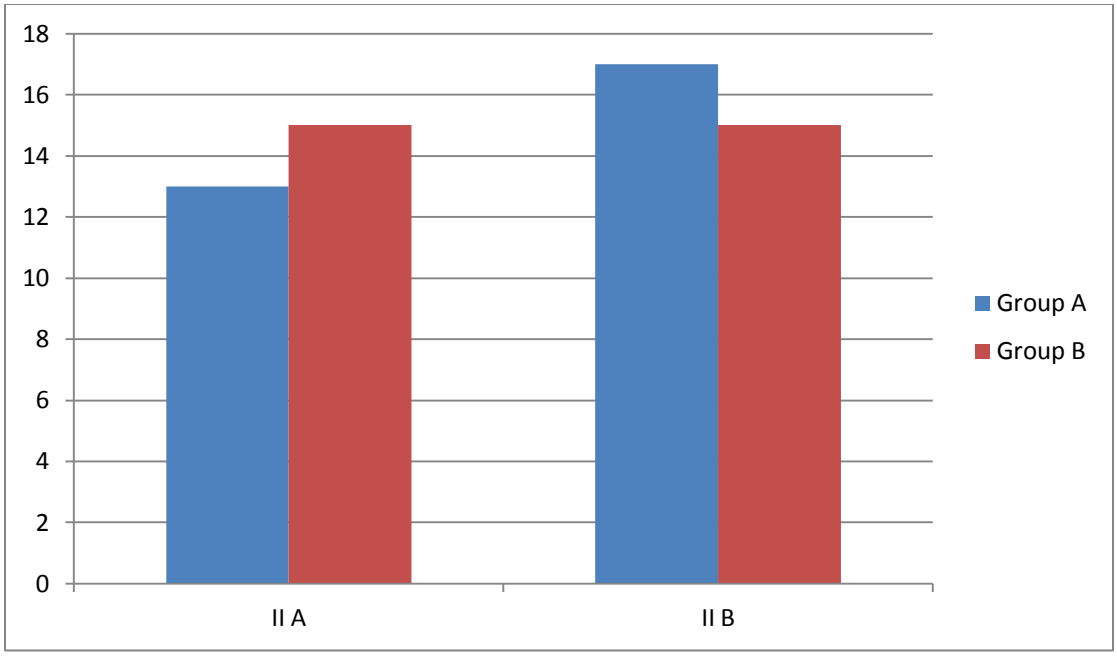
STAGE OF THE PATIENT

Table – 3. Stage of the patient

Stage	No. of Patients		Total
	Group A	Group B	
IIA	13	15	28
IIB	17	15	32

In the study, 28 women presented with Stage IIA disease and 32 women presented with stage IIB disease.

Graph–3. Stage of the Patient



COMPARISION OF STUDY GROUPS

Table – 4. Comparison of study groups

Comparison of	**MRM With Axillary Reverse Mapping Group A (n=30) (%)**	**MRM Without Axillary Reverse Mapping Group B (n=30) (%)**
1. Demography		
Mean Age	49±8	48±7
2. Location		
Right	18 (60)	17 (57)
Left	12(40)	13 (43)
3. Stage of the Patient		
IIA	13 (43)	15 (50)
IIB	17 (57)	15 (50)

In the present study, modified radical mastectomy with axillary reverse mapping was performed in 30 women with mean age 49±8 years.

Of the 30 women, 18 (60%) had Right sided breast carcinoma and 12 (40%) had left sided breast carcinoma.

Of the 30 women, 13 (43%) women belonged to stage IIA at presentation and 17 (57%) women belonged to stage IIB.

Modified radical mastectomy without axillary reverse mapping was performed in 30 women with mean age 48±7 years.

Of the 30 women, 17 (57%) had Right sided breast carcinoma and 13 (43%) had left sided breast carcinoma.

Of the 30 women, 15 (50%) women belonged to stage IIA at presentation and 15 (50%) women belonged to stage IIB.

POST-OPERATIVE FOLLOW UP

Post-operatively the arm circumference was measured for all patients in both groups on day 14,day 30 and on day 60 and the datas has been compared between two groups (A&B). The results were compared with p value using Chi Square test.

Table – 5. MID ARM CIRCUMFERENCE IN GROUP A

MIDARM CIRCUMFERENCE	No. of Patients In Group A	
	Not Increased	Increased
Day 14	30	0
Day 30	29	1
Day 60	29	1

Graph : MID ARM CIRCUMFERENCE IN GROUP A

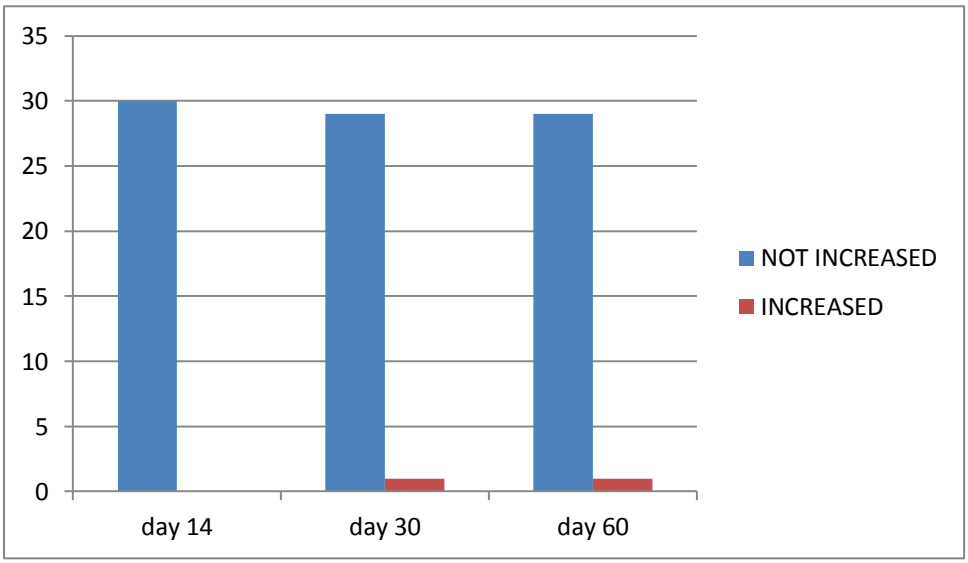
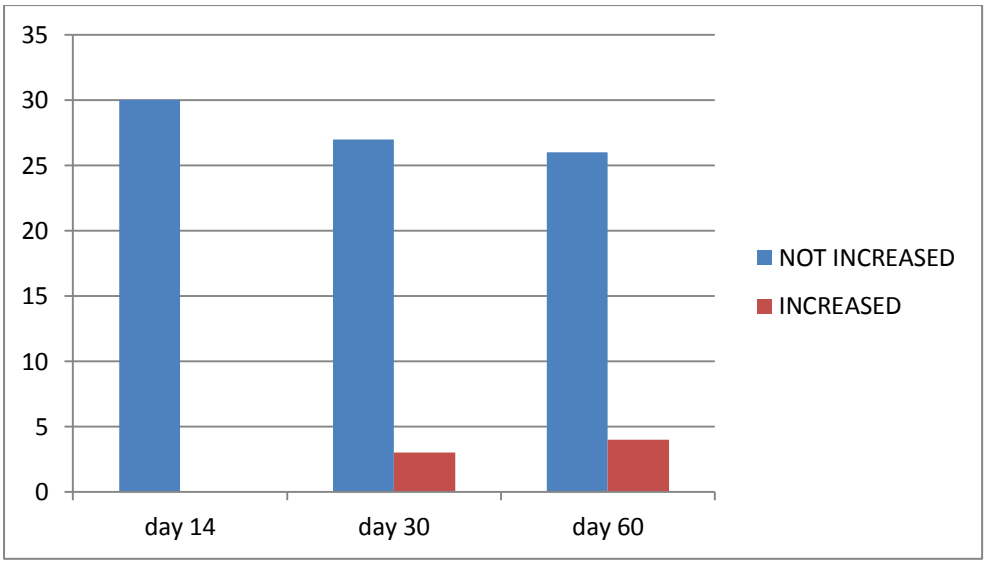


Table – 6. MID ARM CIRCUMFERENCE IN GROUP B

MIDARM CIRCUMFERENCE	No. of Patients in Group B	
	Not Increased	Increased
Day 14	30	0
Day 30	27	3
Day 60	26	4

Graph : MID ARM CIRCUMFERENCE IN GROUP B



In the present study, the Mid arm circumference in post-operative days 14. 30 and day 60 in Group A (MRM with axillary reverse mapping) was compared with Group B (MRM without axillary reverse mapping) .

There is no difference in arm circumference of the patients in both study group and control group on Day 14. And the p value was found to be 1 (p value >0.05 and is not significant).It indicates there is no statistical significance on Day 14.

There is significant increase in arm circumference of the patients with 1 in Group A and 3 in Group B on Day 30. And the p value was found to be 0.04. p value was found to be significant (<0.05). There is statistically significant difference in the arm circumference measurement in both Group A and Group B on Day 30.

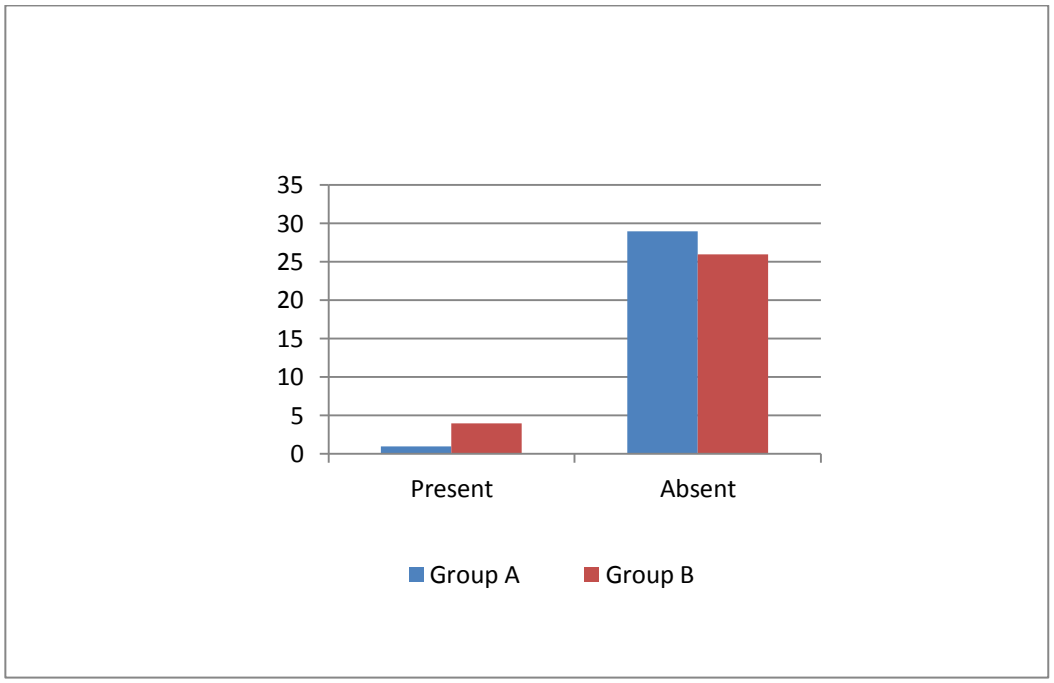
There is significant increase in arm circumference of the patients with 1 in Group A and 4 in Group B on Day 60. And the p value was found to be 0.001. p value was found to be significant (<0.05). There is statistically significant difference in the arm circumference measurement in both Group A and Group B on Day 60.

INCIDENCE OF LYMPHEDEMA

Table – 7. Incidence of Lymphedema

Lymphedema	Group A	Group B	Total
Present	1	4	5
Absent	29	26	55

Graph : Incidence of Lymphedema



In the present study, the incidence of lymphedema formation in Group was compared with Group B.

1 patients developed Lymphedema in group A vs 4 in group B. p value was 0.001 and found to be significant (<0.05).

DISCUSSION

Lymphedema is a significant problem following axillary dissection for breast cancer, which is now considered as common complication, greatly and seriously influenced the quality-of-life of patients.

The variations in arm lymphatic drainage put the arm lymphatics at risk for disruption during ALND. Therefore, mapping the drainage of the arm with blue dye and preserving the identified lymphatics would help in identification and decrease the likelihood of disruption of the lymphatics draining the arm during ALND preventing the chance of lymphedema formation.

The objective of this study was to put a spot on the effect of axillary reverse mapping (ARM) technique on the incidence of lymphedema after modified radical mastectomy (MRM)..

In this study, 60 women with Breast cancer, who underwent modified radical mastectomy, were evaluated for lymphedema formation in two study groups (group A – 30 women, and group B – 30 women).

There were no significant differences between the two groups with regard to age and stage of the disease,

In group A, 30 women who underwent modified radical mastectomy ,the axillary dissection was done using axillary reverse mapping and only unstained nodes were removed during the procedure preserving the blue stained nodes.

In group B, 30 women who underwent modified radical mastectomy,the routine axillary dissection was done without axillary reverse mapping.

In all the patients, tape measurement of the arm circumference 10cm above and below olecranon process was used to detect lymphoedema. This was done preoperatively and 2 weeks, 1 and 2 months postoperatively. The patients who developed lymphedema by clinical examination were recorded.

The results shows that there was a significant reduction in incidence of lymphedema favoring the study (ARM) group and documenting that the ARM procedure was the cause for this reduction. It was 3.3% (1 patients out of 30) in study group compared to 13.33% (4 patients out of 30) in control group ($P < 0.05$). This matches with Tummel E et al study that documented the total lymphedema rate was 21.4% (33/154) of ALND patients which dropped to 6.9% (5/72) ALND with implication of ARM procedure.Similar result was documented by Yue T et al, where the incidence of lymphedema in control group was 33.07% compared to 5.93% in ARM group. Many authors agree with our results that ARM facilitates the preservation of lymphatics draining the arm and decreases the post-operative lymphedema rate.

Ikeda K et al, concluded that Information regarding the ARM factors could predict the incidence of arm lymphedema in patients with breast cancer following post axillary surgery and documented that ARM node positivity is a positive risk factors for lymphedema

CONCLUSION

In the present study, 60 women have completed the study protocol. Of this 30 women in group A (MRM with axillary reverse mapping) and 30 women in group B (MRM without axillary reverse mapping).After analyzing the data and observations,

The present prospective study demonstrated that the Axillary dissection using Axillary reverse mapping technique significantly decreases the incidence of post-operative lymphedema.

However, the sample size in the current study is relatively smaller, so a larger study sample may be needed before any further conclusion can be made.

Although the study sample is small in this present study, it is still wise to recommend use of axillary reverse mapping in patients undergoing modified radical mastectomy. So when performing modified radical mastectomy, the axillary reverse mapping technique is a valuable technique for reducing lymphedema formation and increased patient satisfaction.

SUMMARY

"Prospective study of comparing axillary lymphnodes using axillary reverse mapping during modified radical mastectomy" Conducted in department of general surgery at government rajaji hospital, Madurai from September 2018 to September 2019.

Data collected in a prescribed proforma, analyzed and evaluated for lymphedema formation .

Sample size was 60 women in two groups, group A - 30 (MRM with axillary reverse mapping) and group B – 30 (MRM without axillary reverse mapping). All 60 women completed study protocol.

Of the 60 women, 30 women with mean age 49±8 years belongs to group A and 30 women with mean age 48±7 years belongs to group B.

36 (45%) women presented with stage IIA disease and 44 (55%) with stage IIB disease.

There is no difference in arm circumference of the patients in both study group and control group on Day 14. And the p value was found to be 1 (p value >0.05 and is not significant).It indicates there is no statistical significance on Day 14.

There is significant increase in arm circumference of the patients with 1 in Group A and 3 in Group B on Day 30. And the p value was found to be 0.04. p value was found to be significant (<0.05). There is statistically significant difference

in the arm circumference measurement in both Group A and Group B on Day 30.

There is significant increase in arm circumference of the patients with 1 in Group A and 4 in Group B on Day 60. And the p value was found to be 0.001. p value was found to be significant (<0.05). There is statistically significant difference in the arm circumference measurement in both Group A and Group B on Day 60.

Only 1 patients developed lymphedema in group A vs 4 in group B. p value was 0.001 and found to be significant (<0.05).

The present prospective study demonstrated that the modified radical mastectomy using axillary reverse mapping for axillary dissection significantly decreases the incidence of lymphedema formation.

However, the sample size in the current study is relatively smaller, so a larger study sample may be needed before any further conclusion can be made.

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MADURAI MEDICAL COLLEGE AND GOVERNMENT RAJAJI HOSPITAL, MADURAI

"Prospective study of comparing axillary lymphnodes using axillary reverse mapping during modified radical mastectomy**"**

PROFORMA:

Name: I. P. No:

Age/Sex: Date of Admission:

Occupation: Date of Operation:

Address: Date of Discharge:

CHIEF COMPLAINTS:

1) Breast Lump

2) Nipple discharge

3) Pain in the Breast

4) Loss of weight/Appetite

PAST HISTORY:

1) History of similar complaints

2) Treatment taken

3) History suggestive of Hypertension / Diabetes / Tuberculosis / heart

disease / jaundice / thyroid disorder/epilepsy

PERSONAL HISTORY:

Diet: Vegetarian / Mixed

Habits: Smoking / Alcohol / Tobacco

MENSTRUAL HISTORY:

Regular / Not Duration

Associated / Not with pain L.M.P.

L.C.B.

GENERAL PHYSICAL EXAMINATION:

1. General survey

2. Body build and nourishment

3. Appearance

4. Anaemia / Jaundice / Clubbing Cyanosis / Lymphadenopathy / Pedal oedema.

5. Pulse

6. Temperature

7. Respiratory rate

8. Blood pressure

9.Arm circumference measurement

SYSTEMIC EXAMINATION

1. Cardiovascular system

2. Respiratory System

3. Central nervous system

4. Genito - urinary system

5. Abdomen:

6. DRE: sphincter tone/ palpable mass

7. P/V: cervical os/ presence of mass/ bleeding/discharge

EXAMINATION BREAST AND AXILLA

Nipple/Areola

Skin: ulceration/redness Palpable Mass

Axilla: lateral/medial/central/apical lymphadenopathy

INVESTIGATIONS

1. Blood: Hb%

2. BT

3. CT

4. Blood group and Rh type.

5. Blood: Sugar / Urea / Creatinine

6. ECG

7. X-ray chest PA view

8. USG Both breast with Axilla

9. Others

DIAGNOSIS

STAGE OF DISEASE: TREATMENT

Type of operation:

Type of Anaesthesia: Intra operative findings:

Axillary Dissection technique: With Axillary reverse mapping or not

Post - operative period:

Arm circumference measurement on day 14, 30 and 60

Lymphedema complication: +/-

KEY TO MASTER CHART

SL.NO: Serial Number IP NO: In-patient number

AGE: In Years SEX: M: Male, F: Female

SIDE: RT: Right LT: Left

STAGE: AJCC TNM staging

MRM: Modified Radical Mastectomy

AXILLARY DISSECTION:

GROUP A: With Axillary reverse mapping

GROUP B: Without Axillary reverse mapping

MAC : MID ARM CIRCUMFERENCE :

pre-operative, post-operative day 14, day 30 and day 60 in cm.

LYMPHEDEMA: + present, - absent

MASTER CHART

S.NO	NAME	AGE	SEX	IP NO	SIDE	STAGE	PROCE	AXILLA	MAC PRE	MAC DA	MAC DA	MAC DA	LYMPHED
Co	Column2	Co	C	Colum	Colu	Col	Colu	Col	Colum	Colun	Colun	Colum	Colum
1	selvi	30	F	3826	Right	IIA	MRM	A	27	27	27	27.3	No
2	kalpana	36	F	105255	Right	IIB	MRM	A	26	26	26.1	26.2	No
3	fousiabanu	38	F	1117161	Left	IIA	MRM	A	31.5	31.5	31.7	21.9	No
4	chinnamal	40	F	77264	Right	IIA	MRM	A	30.5	30.7	30.8	31.1	No
5	selvam	40	F	92465	Right	IIB	MRM	A	26.5	26.5	26.6	26.6	No
6	mariyammal	40	F	57573	Left	IIA	MRM	A	28	28	28.1	28.2	No
7	jeyalakshmi	42	F	7339	Left	IIB	MRM	A	28.2	28.2	28.2	28.2	No
8	selvi	45	F	7953	Right	IIA	MRM	A	29.4	29.4	29.5	29.8	No
9	koodammal	46	F	49763	Left	IIB	MRM	A	30	30.3	30.5	30.6	No
10	tamilselvi	47	F	100443	Right	IIA	MRM	A	27.4	27.4	27.4	27.5	No
11	ragini	48	F	83489	Right	IIB	MRM	A	28	28	28.2	28.4	No
12	veerammal	48	F	91258	Right	IIB	MRM	A	26	26.1	26.1	26.2	No
13	karpagam	50	F	58615	Right	IIB	MRM	A	28.9	28.9	29	29.2	No
14	indirani	50	F	1121996	Right	IIA	MRM	A	28.5	28.5	28.8	28.8	No
15	yasothai	50	F	9614	Left	IIB	MRM	A	28	28.1	28.3	28.6	No
16	muthulakshmi	50	F	15125	Right	IIA	MRM	A	29.5	29.5	29.5	29.6	No
17	tamilselvi	50	F	14981	Right	IIB	MRM	A	29	29.1	29.1	29.4	No
18	lakshmi	51	F	67529	Left	IIB	MRM	A	28	28	28.1	28.2	No
19	loganayaki	52	F	53447	Right	IIA	MRM	A	27	27	27	27.4	No
20	parvathy	52	F	57615	Right	IIB	MRM	A	27.6	27.6	27.8	28	No
21	tharanidevi	53	F	18327	Left	IIB	MRM	A	28	28	28.1	28.1	No
22	velammal	55	F	37974	Right	IIB	MRM	A	28	28	28.2	28.2	No
23	shenbagavalli	57	F	48403	Right	IIB	MRM	A	26.5	26.7	26.7	26.8	No
24	pandiyammal	58	F	66237	Left	IIB	MRM	A	30.5	30.5	30.5	30.5	No
25	therasa	60	F	49496	Left	IIB	MRM	A	28.2	28.2	28.3	28.5	No
26	karupayee	60	F	43608	Left	IIB	MRM	A	29	29.8	31.1	31.6	yes
27	marytamilselvi	61	F	65261	Right	IIA	MRM	A	26	26	26.2	26.2	No
28	sebastifrachon	61	F	52706	Left	IIA	MRM	A	27.5	27.6	27.8	27.8	No
29	kunjaram	62	F	69126	Right	IIA	MRM	A	29	29	29	29.2	No
30	vijaya	64	F	31966	Left	IIA	MRM	A	26.6	26.7	26.8	27	No

S.N	NAME	AG	SI	IP NO	SIDE	STA	PRO	AXI	MAC I	MAC	MAC	MAC	LYMPI
1	panchavarnam	47	F	72424	Left	IIB	MRM	B	29.3	29.5	29.5	29.5	No
2	maragatham	66	F	78148	Right	IIA	MRM	B	27.5	27.5	27.5	27.5	No
3	vijayakumari	42	F	1154	Left	IIB	MRM	B	30	30.8	32	32.8	yes
4	selvi	40	F	10386	Right	IIA	MRM	B	25.5	25.7	25.7	25.8	No
5	valliyammal	65	F	51587	Left	IIB	MRM	B	26.5	26.5	26.5	26.5	No
6	kaliyammal	50	F	19897	Right	IIA	MRM	B	27.5	27.5	27.5	27.5	No
7	ilaiyarasi	40	F	19893	Left	IIA	MRM	B	27	27.2	27.2	27.3	No
8	banumathi	55	F	45041	Right	IIB	MRM	B	28.5	29.2	30.6	31.2	yes
9	chenni	40	F	50224	Right	IIA	MRM	B	27.5	27.7	27.7	27.8	No
10	panchu	40	F	9928	Right	IIB	MRM	B	31.2	31.2	31.2	31.2	No
11	mariyammal	48	F	54622	Right	IIB	MRM	B	28.5	28.5	28.5	28.5	No
12	saroja	57	F	36842	Right	IIA	MRM	B	27.5	27.5	27.5	27.5	No
13	kunjuram	45	F	69126	Left	IIA	MRM	B	28	28.1	28.1	28.2	No
14	mariyammal	49	F	74049	Right	IIA	MRM	B	25.3	25.3	25.3	25.3	No
15	kalpana	33	F	9533	Right	IIB	MRM	B	29	29	29	29	No
16	amutha	40	F	69806	Left	IIB	MRM	B	27.7	28.5	29.7	30.6	yes
17	lakshmi	60	F	654	Right	IIA	MRM	B	29	29.2	29.3	29.4	No
18	parvathy	80	F	25821	Right	IIB	MRM	B	27.5	27.6	27.7	27.8	No
19	thillaiammal	34	F	15127	Right	IIA	MRM	B	31.1	31.1	31.2	31.2	No
20	kanagavalli	29	F	36206	Left	IIB	MRM	B	30.3	30.5	30.8	40.2	No
21	rajammal	78	F	46137	Left	IIB	MRM	B	28.2	28.5	28.7	29.1	No
22	rajathi	47	F	59205	Right	IIA	MRM	B	31	31.9	32.2	33.8	Yes
23	muthumari	40	F	7710	Left	IIA	MRM	B	29.4	29.6	29.9	30.3	No
24	devika	58	F	41091	Right	IIB	MRM	B	29.8	29.8	30	30	No
25	ramayeeamma	70	F	48609	Left	IIB	MRM	B	27	27	27.4	27.5	No
26	vasantha	45	F	40790	Right	IIA	MRM	B	28.5	28.6	28.8	28.8	No
27	sankaraselvi	40	F	70952	Left	IIB	MRM	B	32.2	32.4	32.5	32.6	No
28	latha	45	F	92318	Right	IIB	MRM	B	29.5	29.7	29.7	29.7	No
29	mariyammal	40	F	45142	Left	IIA	MRM	B	28.5	28.5	28.5	28.5	No
30	muthusumathi	40	F	62465	Left	IIA	MRM	B	31.6	31.7	31.8	31.9	No

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ETHICS COMMITTEE CERTIFICATE

Name of the Candidate	:	Dr. Karthikeyan .R
Course	:	PG in MS., General Surgery
Course of Study	:	2017-2020
College	:	MADURAI MEDICAL COLLEGE
Research Topic	:	Prospective study of Comparing axillary lymphnodes using axillary reverse mapping during modified radical mastectomy
Ethical Committee as on	:	25.09.2018

The Ethics Committee, Madurai Medical College has decided to inform that your Research proposal is accepted.

Member Secretary | Chairman | Dean / Convenor

Prof Dr V Nagaraajan
M.D., MNAMS, D.M., Dsc.,(Neuro), Dsc (Hon)
CHAIRMAN
IEC - Madurai Medical College
Madurai

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25 SEP 2018

CERTIFICATE – II

This is to certify that this dissertation work titled "PROSPECTIVE STUDY OF COMPARING AXILLARY LYMPHNODES USING AXILLARY REVERSE MAPPING DURING MODIFIED RADICAL MASTECTOMY"of the candidate Dr.KARTHIKEYAN.R with Registration Number 221711111 for the award of MASTER DEGREE in the branch of GENERAL SURGERY. I have personally verified the urkund.com website for the purpose of plagiarism check. I found that the uploaded thesis file contains from introduction to conclusion pages and result shows 6% of plagiarism in the dissertation.

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