“PROSPECTIVE STUDY ON EFFICACY OF MECHANICAL OBLITERATION OF DEAD SPACE FOLLOWING AXILLARY CLEARANCE FOR CARCINOMA BREAST IN REDUCING THE INCIDENCE OF SEROMA FORMATION”

DISSERTATION SUBMITED FOR

BRANCH I – M.S (GENERAL SURGERY)

APRIL 2017

THE TAMILNADU DR.M.G.R. MEDICAL UNIVERSITY

CHENNAI

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CHENNAI

BONAFIDE CERTIFICATE

This is to certify that the dissertation entitled **"PROSPECTIVE STUDY ON EFFICACY OF MECHANICAL OBLITERATION OF DEAD SPACE FOLLOWING AXILLARY CLEARANCE FOR CARCINOMA BREAST IN REDUCING THE INCIDENCE OF SEROMA FORMATION"** is the bona fide work of **Dr. Lakshmanan C** in partial fulfilment of the university regulations of the Tamil Nadu Dr. M.G.R. Medical University, Chennai, for M.S (Branch I) General Surgery examination to be held in April 2017.

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DECLARATION

I, **Dr. Lakshmanan C**, do hereby declare that I carried out this work on **"prospective study on efficacy of mechanical obliteration of dead space following axillary clearance for carcinoma breast in reducing the incidence of seroma formation"** at the Department of Surgery, Govt. Rajaji Hospital, Madurai, under the guidance of **Prof. Dr. A. M. Syed Ibrahim M.S.,** Professor of Surgery, during the period of six months.

I also declare that this bonafide work has not been submitted in part or full by me or any others for any award, degree or diploma to any other University or Board either in India or abroad.

This is submitted to The Tamil Nadu Dr. M.G.R. Medical University, Chennai in partial fulfilment of the rules and regulations for the M.S degree examination in General surgery (Branch I) to be held in April 2017.

Place : Madurai.

Date :

Dr. Lakshmanan C

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ABSTRACT

Background and objectives:

Seroma formation and its sequelae including infection, flap necrosis, delayed wound healing and patient discomfort form one of most commonly encountered complication following mastectomy and axillary dissection.

Mechanical closure of dead space by flap fixation is a simple surgical procedure that eliminates dead space after mastectomy, by decreasing the movement of flap over chest wall and thereby reducing the exudate.

The objective of this study is to evaluate the effect of mechanical closure of dead space after mastectomy in prevention of seroma formation.

Method:

A total of 80 patients of Carcinoma Breast who underwent Modified Radical Mastectomy in Department of general surgery, Government Rajaji Hospital, Madurai during the period from march 2016 to august 2016, were included in this prospective study, and randomized into two groups based on in-patient number. 42 patients with odd IP no in conventional simple wound closure (Group A) and 38 patients with even IP no in Flap fixation (Group B). Patients were evaluated for day 1 drain volume, total drain volume, drain removal day, seroma, and wound complications.

Result:

Of the 80 women, 42 women with mean age 48$\pm$8 years belongs to group A and 38 women with mean age 46$\pm$7 years belongs to group B.

Average size of the tumor at presentation was 3.4cm.

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

Drain volume in first post-operative day varied from 100 to 200ml with average of 170ml in group A and 163ml in group B. There was no statistically significant difference in the drain volume in first post-operative day ($p>0.05$).

The average total drain volume in the post-operative period in group A was 1426ml and 932ml in group B. p value was found to be significant (<0.001).

The average day of drain removal in group A was 13 days and 8 days in group B. p value was found to be significant (<0.001).

8 patients developed seroma in group A vs none in group B. p value was found to be significant (>0.05).

One patient developed wound complication (cellulitis) vs none in group B. There was no statistically significant difference in the incidence of wound complications in both groups

Conclusion:

The present prospective study demonstrated that the mechanical obliteration of dead space by flap fixation significantly decreases the incidence of seroma formation.

So when performing modified radical mastectomy, the flap-fixation technique is a valuable technique for reducing seroma formation allowing early drain removal and increased patient satisfaction.

Keywords: Carcinoma breast; Modified radical mastectomy; Axillary clarance; Seroma; Flap fixation;

TABLE OF CONTENTS

1.	INTRODUCTION	1
2.	OBJECTIVES	3
3.	REVIEW OF LITERATURE	4
4.	METHODOLOGY	59
5.	RESULTS AND OBSERVATION	62
6.	DISCUSSION	75
7.	COCLUSION	78
8.	SUMMARY	79
9.	BIBLIOGRAPHY	81
10.	ANNEXURES	
	ANNEXURE-I: PROFORMA	91
	ANNEXURE-II: KEY TO MASTER CHART	94
	ANNEXURE-III: MASTER CHART	95

INTRODUCTION

Seroma formation and its sequelae including infection, flap necrosis, delayed wound healing and patient discomfort form one of most commonly encountered complication following mastectomy and axillary dissection varying in incidence from 3 to 85 % (1). Seroma formation after breast cancer surgery is a persistent problem much to the annoyance of surgeon and patient alike, in spite of advances in surgical techniques and hemostasis.

Pathophysiology of seroma is not clear and it is widely discussed in literature. Seroma is formed by acute inflammatory exudates in response to surgical trauma and acute phase of wound healing or fibrinolytic activity in serum or lymph drainage (5).

Seroma is influenced by large dissection area, dead space under the skin flaps and axillary region, shoulder movement which affects attachment of skin flaps. The incidence of seroma is correlated with obesity, hypertension, breast volume, early shoulder exercise, and use of heparin, tamoxifen (2-4).

Seroma accumulation elevates the flaps from the chest wall and axilla there by hampering their adherence to the tissue bed. It thus can lead to significant morbidity such as wound hematoma, delayed wound healing, wound infection, wound dehiscence, prolonged hospitalization, delayed recovery and initiation of adjuvant therapy.

Number of techniques have been employed in an attempt to reduce or prevent seroma formation among mastectomy patients using mechanical and chemical approaches. However, there is heterogeneity in their benefits and there is paucity of uniform evidence for their use.

Mechanical closure of dead space by flap fixation is a simple surgical procedure that eliminates dead space after mastectomy. The objective of this study is to evaluate the effect of mechanical closure of dead space after mastectomy in prevention of seroma formation.

AIMS AND OBJECTIVES

1. To evaluate the efficacy of mechanical obliteration of dead space following axillary clearance for carcinoma breast in reducing the incidence of seroma formation.

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 (6).

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 (7,8).

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 (9). 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 (10). 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, th*e* 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

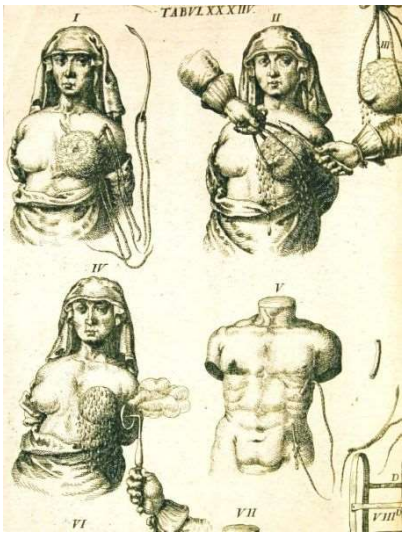
or a modified radical mastectomy. Node-positive patients received adjuvant cyclophosphamide, methotrexate, and 5-fluorouracll (CMF) chemotherapy or adjuvant melphalan. After a median follow-up of 15 years. neither type of surgery nor type of chemotherapy was shown to affect loco-regional disease-free 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 (11):

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)

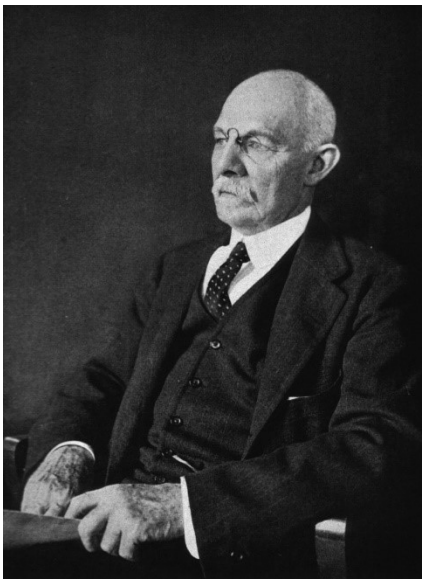
Chronological history of operations related to partial mastectomy:

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 (12, 13). However, local recurrence rates have been generally increased (14). 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 (15,16). 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 (17,18).

EMBRYOLOGY[19]

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[20, 21, 22, 23]

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.

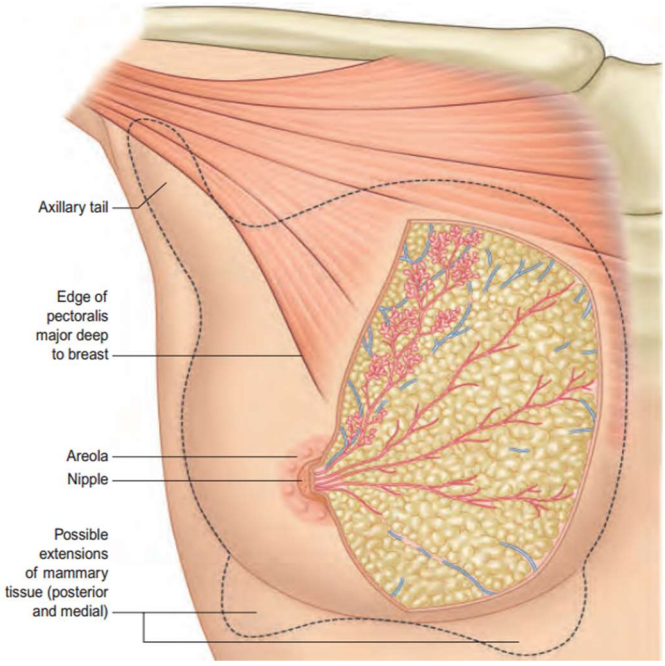
Tributaries of the axillary vein follow the course of the branches of the axillary artery, usually in the form of venae comitantes, paired veins that follow the course of the artery. The cephalic vein passes in the groove between the deltoid and pectoralis major muscles, and thereafter enters the axillary 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.

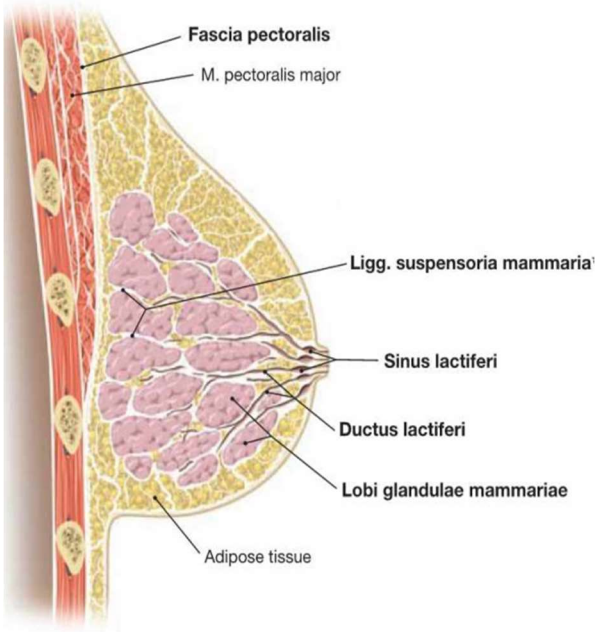
Blood Supply of Breast:

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

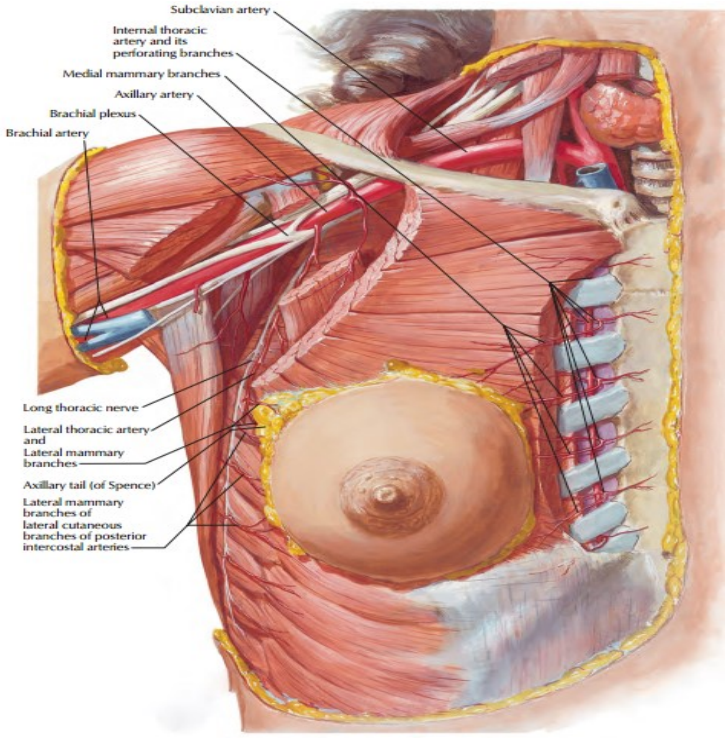
branches allow perfusion to the serratus anterior muscle, both the pectoralis muscles, and the subscapularis muscle, and also supply the axillary lymphatics and supporting fatty tissues. The posterior intercostal arteries give rise to mammary branches in the second, third, and fourth intercostal spaces. 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. V*eins 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.



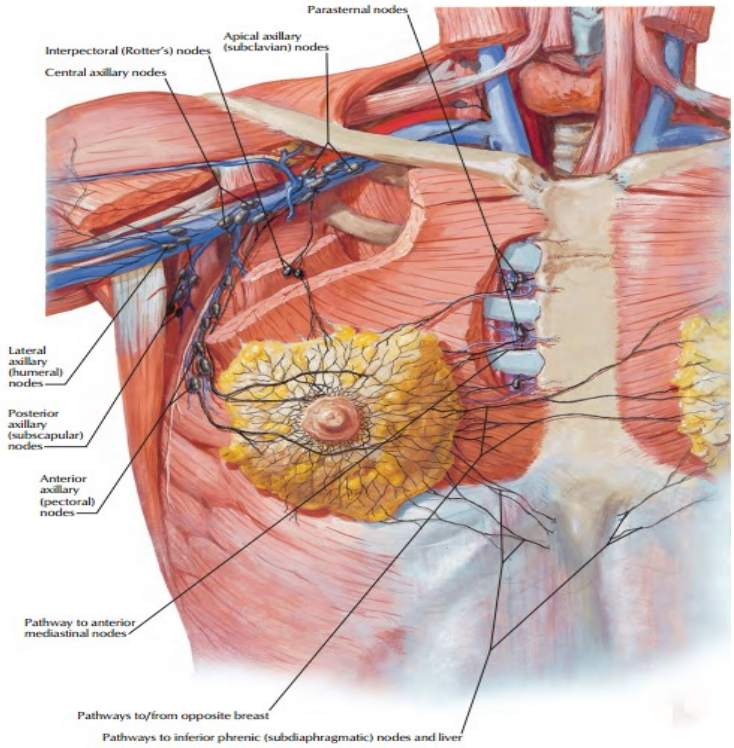
Topography of Breast



Breast – Sagittal View



Blood Supply



Lympahatics

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[24, 25]:

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[26]:

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.

Harmonal Factors[27, 28, 29]:

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[30, 31, 32]:

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[33]:

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 (LCIS) Lobular carcinoma in situ

Tis (Paget's) Paget's disease of the nipple NOT associated with invasive carcinoma and/or carcinoma in situ (DCIS and/or LCIS) 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[34]:

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 fibroadeno ma 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[35, 36, 37]:

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[38]

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 horacic 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.

Wound closure:

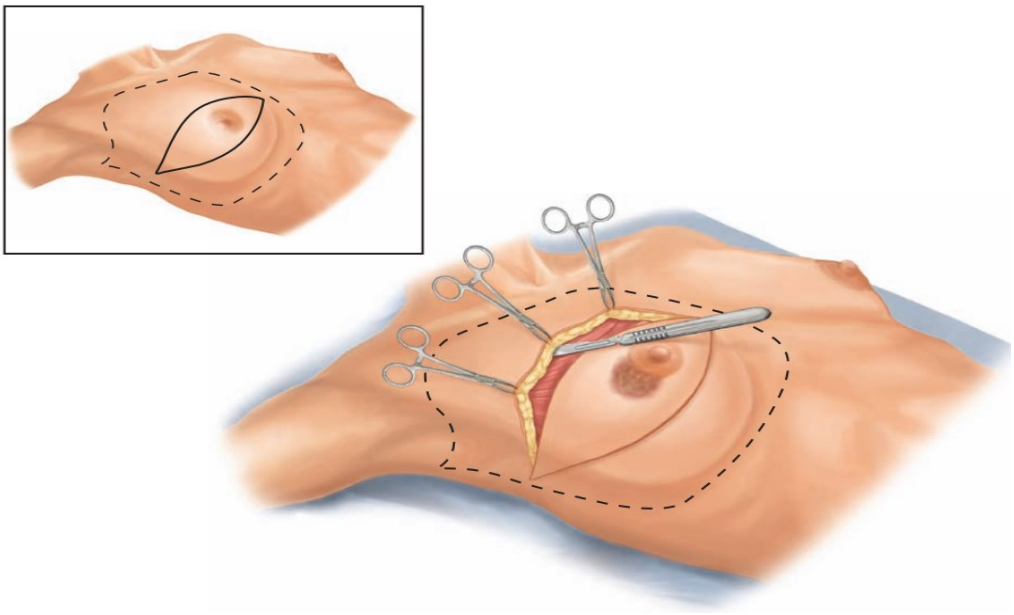
Closed-suction silastic catheters (14 French) are placed via separate stab wounds entering the inferior flap near the anterior axillary line. Placement of the lateral catheter in the axillary space approximately 2 cm inferior to the axillary vein on the ventral surface of the latissimus dorsi muscle ensures drainage of the axilla space. The longer second catheter is placed medially and inferiorly to the wound bed to provide continuous drainage of blood and serum from the space between the skin flaps and the chest wall. Both catheters secured in place with separate 2-0 silk sutures. Skin flap sutured to underlying pectoralis major with multiple rows of 2-0 vicryl. The wound is closed in two layers, first with absorbable 2-0 Vicryl suture to approximate the subcutaneous tissues ensuring bites in the cutis reticularis of the skin flap and 2-0 Ethilon sutures for skin closure.

Post operative Course:

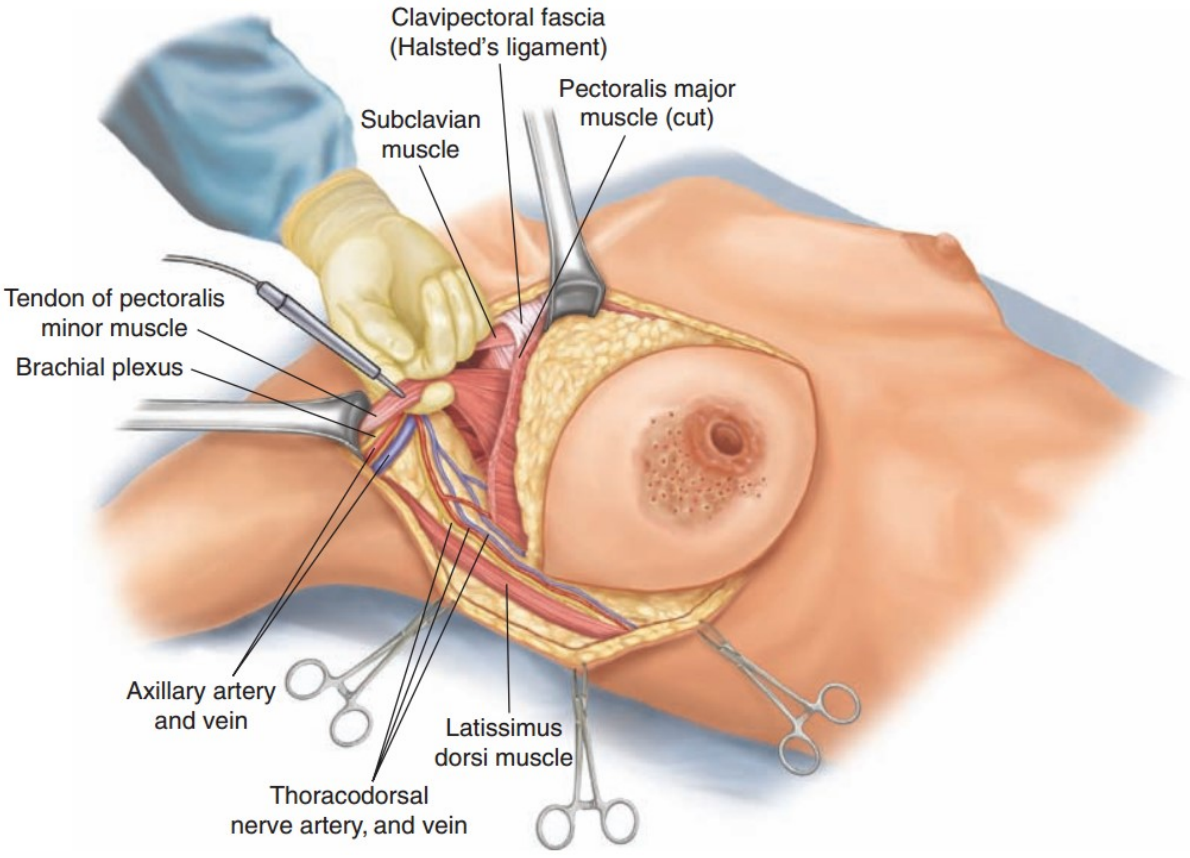
Daily drain output recorded.

The drains are removed when output is less than 30 cc/day for 24 hours.

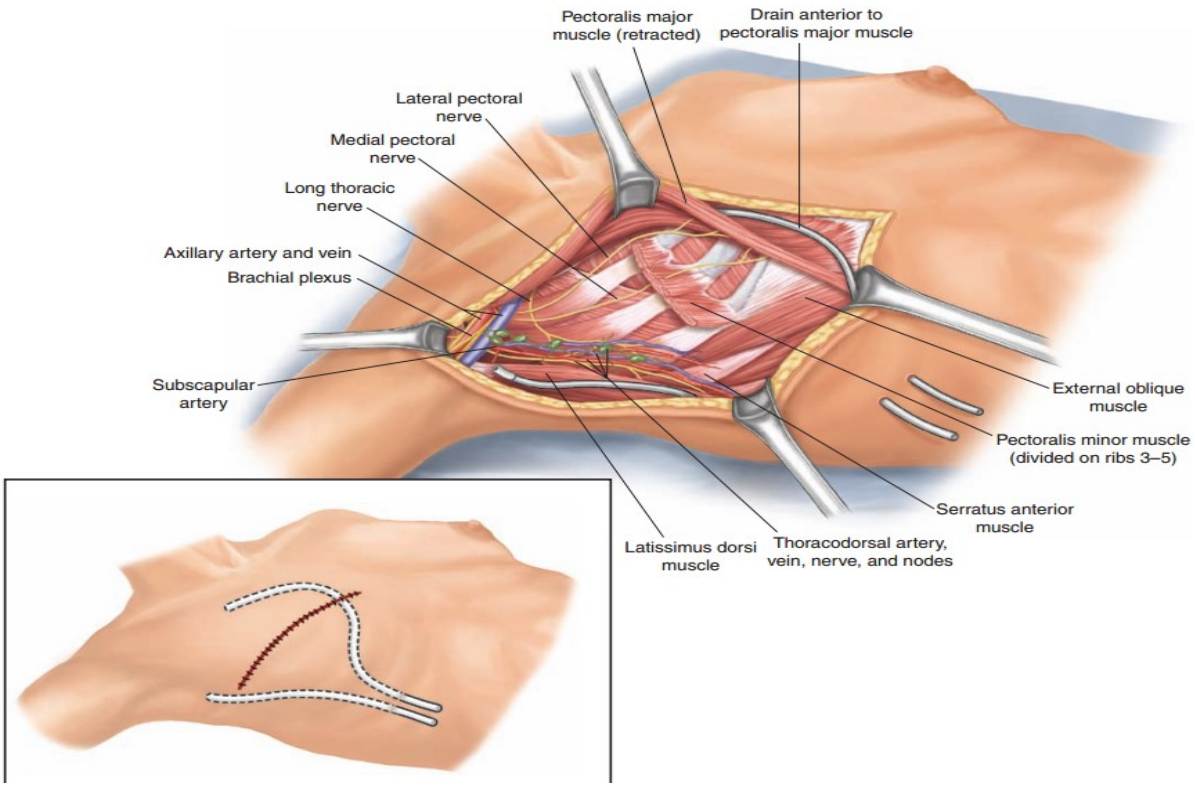
Range-of-motion exercises are initiated about 2 days after surgery.



Limits of Modified Radical Mastectomy



Axillary Dissection in Patey's Modified Radical Mastectomy



Completed Axillary Dissection

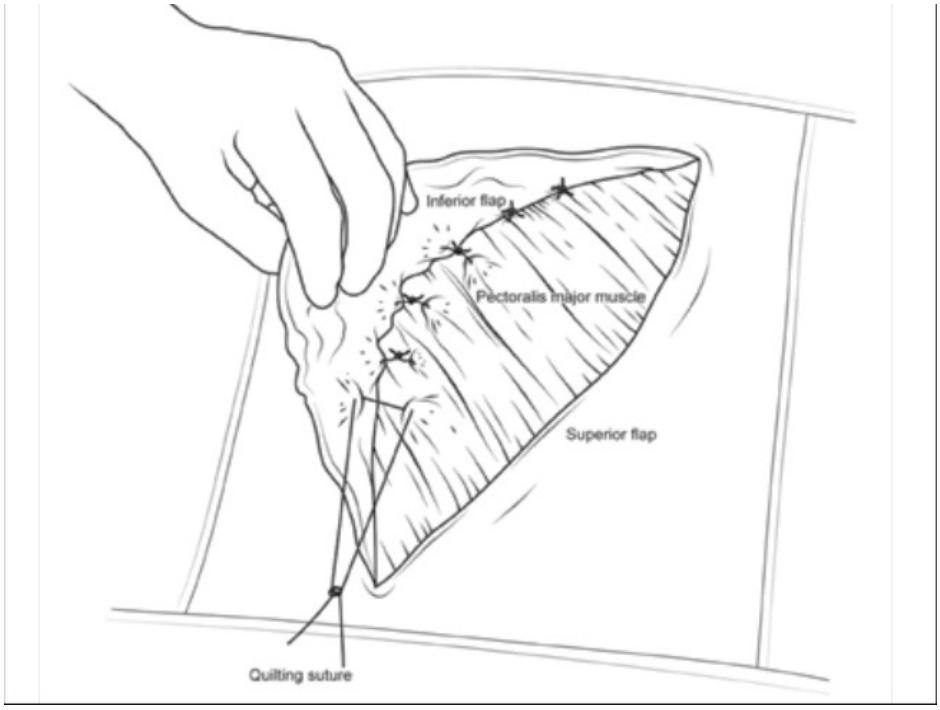
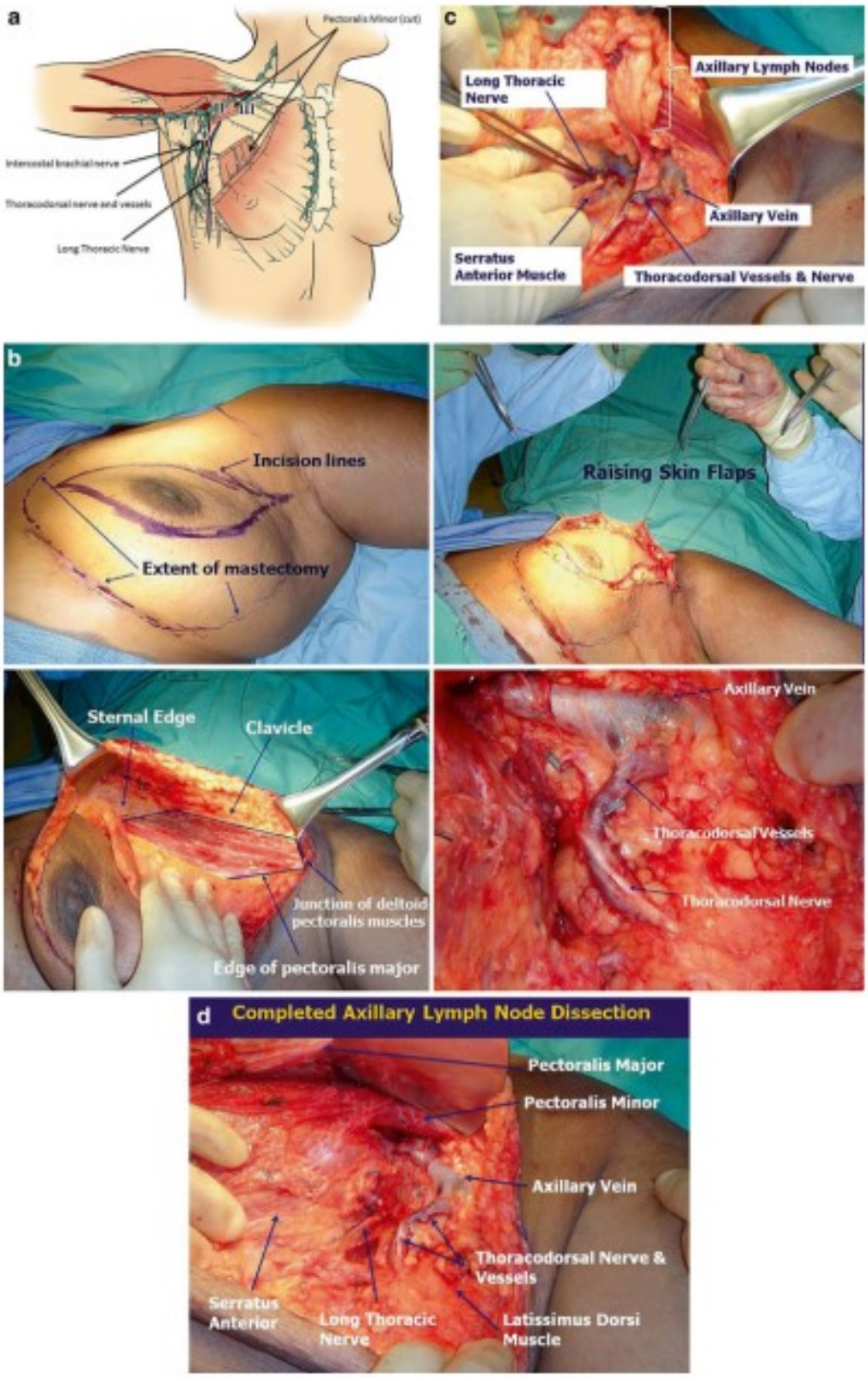


Illustration of Flap fixation



Modified Radical Mastectomy - Steps

COMPLICATIONS[39]:

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.

Lymphedema- The incidence of functionally significant lymphedema after a modified radical mastectomy is s 10%. 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.

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

SEROMA

Seroma formation is the most frequent postoperative complication seen after mastectomy and axillary surgery with an incidence of 3% to 85%. It is so common that it is now believed to be a side effect of surgery rather than a complication. Associated morbidity in the form of prolonged drainage is not only troublesome to the patient but can also significantly impact treatment by delaying adjuvant therapy and increasing the risk for infection.

PATHOPHYSIOLOGY

Seroma after breast surgery is defined as a serous fluid collection that develops under the skin flaps or in the axillary dead space following mastectomy and/or axillary dissection. The origin of seroma remains unclear but several risk factors and predictors are age, breast size, comorbid conditions, presence and number of malignant nodes in the axilla, previous surgical biopsy, and use of heparin or tamoxifen . It has been hypothesized that seromas form as an exudate from an acute inflammatory reaction following surgical trauma to increase serous fluid collection in response to increased fibrinolytic activity in serum and lymph. Low fibrinogen levels in seromas compared with those in plasma during the postoperative period support the hypothesis that seroma most likely originates from lymph. Seroma formation is influenced by an array of surgical techniques and devices; thus, leading to varying incidence of seroma in different studies.

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 increases seroma formation compared with that of simple mastectomy (40, 41), but the association is inconclusive when radical mastectomy is compared with modified radical mastectomy (MRM). Conversely patients undergoing MRM have a significant increased incidence of seroma formation when compared to those who have breast conservation surgery (42). Preservation or removal of the pectoral fascia has no effect on the incidence of seroma (43). It has also been observed that immediate breast reconstruction following MRM decreases seroma formation when compared to a delayed procedure (44). The number of removed lymph nodes probably does not influence seroma formation (45, 46). 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 (47).

Surgical devices

Various electro-mechanical devices are used during surgery to reduce blood loss and operating time. These include electrocautery, laser scalpel, argon diathermy, ultrasonic scalpel, ultrasonic scissors, and vessel sealing systems. All of these devices have been investigated in an effort to reduce seroma formation. Randomized trials have shown that the use of electrocautery for dissecting flaps is significantly associated with increased seroma formation when compared to

that of scalpel dissection (48). However, no individual study has shown a significant effect on seroma formation with or without the use of a laser scalpel, argon diathermy, or an ultrasonic scalpel. Ultrasonic scissors resulted in reduced seroma formation in a randomized controlled trial comparing level I and II axillary dissection using either ultrasound scissors or surgical scissors with ligation (49). An Italian group compared the bipolar vessel sealing system with conventional surgical dissection and found no difference in the duration of the surgical procedure, total drainage fluid volume, drainage duration, or postoperative adverse events between the groups in a randomized trial. Interestingly, a significant increase in seroma was observed in the vessel sealing system group. However other studies have reported improved results with use of a vessel sealing system. One of these was a prospective study (50), in which the results were compared with historical data, and decreased drainage duration and hospital stay were observed. Another retrospective study concluded that the drainage duration is significantly shorter with the use of a vessel sealing system but not the cost of treatment. The benefit in terms of fluid loss also remains to be demonstrated. The differences in outcomes probably reflect differences in study methods; thus, further randomized trials with larger sample sizes are required.

OBLITERATION OF DEAD SPACE

Mechanical

Different techniques have been employed to obliterate the dead space (under flaps and the axilla) to reduce seroma formation. Halsted first advocated creating a short superior flap and suturing it with interrupted silk to the fascia below the first rib and skin grafting the remaining part of the defect (51). In 1951, Orr (52) used tension sutures tied over rubber tubing bolsters to

tack flaps to the chest wall. In 1953, Keyes et al. (53) used through and through sutures to attach the skin flaps to the chest wall. Besides these techniques, suturing of flaps with subcutaneous tissue (54), avoiding use of axillary drains following breast conservation therapy (55), and obliterating axillary dead space by muscle approximation (56, 57) have all been tried for reducing seroma formation. Coveney et al. (58) compared suturing skin flaps to underlying muscle with conventional skin closure and observed a lower incidence of seroma formation in the flap suture group, although flap suturing did add to total operating time. A recent randomized study (59) compared a combination of skin flap suturing, ligation of lymphatics and obliteration of axillary dead space to conventional skin closure after mastectomy. As a result, the incidence of seroma formation decreased to 2% with the combination of techniques. Although effective, the authors stated that it was impossible to determine which of the three techniques, or any combination, actually produced the observed effect. Mechanical pressure has also been applied to obliterate dead space following surgery. The use of a pressure garment (60, 61) does not reduce postoperative drainage and has low tolerance and a higher complication rate.

Chemical

Fibrin glue, light activated fibrin sealant, and transdermal photo-polymerized adhesive reduce seroma formation after mastectomy in animal models. Use of a fibrinolysis inhibitor was based on the hypothesis that fibrinolytic activity in serum and lymph might contribute to fluid accumulation. Sanders et al. (62) reported that fibrinogen and thrombin concentrations in the fibrin sealant are proportional to the reduction in seroma formation. However, no significant difference in the incidence of seroma formation occurred with the use of fibrin glue in human

studies (63). In contrast, Vaxman et al. (64) demonstrated in a randomized trial that use of fibrin glue actually increases seroma formation rate. The advantage of using fibrin glue comes from three other studies that demonstrated significantly reduced total seroma drainage, early drain removal, and reduced hospital stay. Most of these studies had a limitation of a relatively small sample size. A reduction in postoperative drainage and hospital stay were observed following use of fibrin glue, but it did not affect delayed seroma formation. However, the use of fibrin glue or peri-operative and postoperative administration of a fibrinolysis inhibitor does not reduce seroma formation.

Various sclerosants have also been used to prevent and manage seroma. A number of agents have been investigated in rat models, including marine mussel protein and the Gram-positive anaerobe *Corynebacterium parvum*. In humans, seromadesis has been reported with talc and hypertonic saline. Although successful, both of these reports were based on the experience of one patient. The most commonly reported sclerosant in the literature is tetracycline, and, similar to fibrin glue, some reports found it useful whereas others did not. Two prospective, randomized trials from the Mayo clinic evaluated the use of tetracycline (65). They first used tetracycline postoperatively, administering it into wound cavities via drains in patients who had undergone mastectomy. This trial was aborted early due to severe pain experienced following the tetracycline administration with no associated benefit. A second trial (66) administered tetracycline intra-operatively and found no difference in postoperative pain between the groups but also found no difference in seroma formation. The non-availability of tetracycline has led to the use of erythromycin as a sclerosant, which is commonly used in pleurodesis. Ali-Khan et al.

(67) showed that erythromycin was useful in one case of breast surgery and three cases of inguinal bloc dissection complicated by refractory seroma formation.

Somatostatin receptors have been discovered in the lymphatic tissue within and outside the gastrointestinal tract and are thought to reduce lymph production when stimulated, although the precise mechanism of action responsible for this effect is not well understood. Octreotide, a long acting and 20 times more potent synthetic analogue of somatostatin has been used successfully to combat chylous ascites and lymphorrhoea following thoracic duct injury. Studies have demonstrated a benefit when administering octreotide following axillary lymph node dissection to reduce the to the duration and volume of lymphorrhoea (68). However further trials are required to establish its true significance.

SHOULDER FUNCTION AND PHYSIOTHERAPY

Shoulder dysfunction is a common complication of mastectomy, and it is necessary to mobilize the shoulder early to prevent this complication. It was thought that early shoulder mobilization led to increased seroma formation and this hypothesis was supported by a systematic review of 12 randomized controlled trials (RCTs) of which six were included in a meta-analysis (69). The study showed that a delayed shoulder exercise program reduces seroma formation (odds ratio, 0.4; 95% confidence interval, 0.2-0.5; p=0.00001) but no differences were found for drainage volume or hospital stay. Conversely, a number of RCTs have demonstrated no difference in seroma formation between early (within 1-2 days postoperatively) or late (by 5-7 days postoperatively) shoulder movement. Temporary immobilization of the shoulder using a collar and cuff or sling has been attempted with an aim to reduce seroma formation but was not found to be beneficial. Thus, the present evidence does not support shoulder immobilization.

Another parallel issue is whether active shoulder mobilization through physiotherapy has any effect on seroma formation. A number of reports comparing delayed physiotherapy, even until removal of the drain showed less total wound drainage, shorter drainage period, and a shorter hospital stay without any difference in the functional range of movement in the longer term. Rodier et al. and van der Horst et al. (70) found no significant difference in seroma production to production following early or delayed physiotherapy. Thus delayed physiotherapy may reduce seroma formation at the expense of mild short-term shoulder dysfunction but without long term restriction of movement.

DRAINS

The use of drains has been a common practice to obliterate the dead space created after surgery. The use of closed suction drainage in patients who underwent mastectomy accelerates wound healing and is also associated with a lower incidence of wound infection, necrosis, and breakdown. A study by Bourke et al. (71) found no difference between using closed suction wound drainage and corrugated wound drainage in 51 patients who underwent simple mastectomy. In a study by Whitfield and Rainsbury (72), no significant difference was observed between suction and closed siphon drainage on the formation of seroma.

Studies comparing the intensity of negative drain suction have shown mixed results. In a study of 46 patients who underwent mastectomy, randomized between high vacuum drain and low vacuum drain, seroma drainage and postoperative hospital stay was longer in the low vacuum system group than that in the high vacuum system possibly because the high vacuum drain led to more efficient flap approximation to the chest wall. In contrast, van Heurn and Brink (73)

found that the mean volume evacuated was significantly lower from a low vacuum system, which lead to early drain removal in 76 patients who underwent axillary dissection with breast-conserving surgery. Bonnema et al. (74) compared high versus low vacuum drainage, in 141 patients undergoing modified radical mastectomy, lumpectomy with axillary dissection or axillary dissection alone. No significant difference was observed in the volume of axillary fluid produced, drainage duration or wound complication rates between the two groups. High vacuum drains had a higher incidence of vacuum loss but a lower incidence of leakage around the drain. Thus, no strong evidence is available to recommend high or low pressure suction to reduce seroma formation.

Early drain removal

It is common practice to remove drains when drainage decreases to a minimal volume (20-50 mL) in the preceding 24 hours to minimize seroma formation. It has been shown that 48 hours after surgery, as much as 74% of the total volume of seroma has been drained. It has also been observed that drains may be safely removed after axillary dissection, if the total drainage during the first 3 days is less than 250 mL. Somers et al. (45) studied 108 patients who underwent level one or two axillary node dissection, whose drains were removed on the first postoperative day regardless of drainage volume and the patients were discharged. No significant difference was observed with respect to drainage volume at the time of drain removal, subsequent mean number of aspirations, and time to resolution of seromas. Parikh et al. (75) randomized 100 patients who underwent mastectomy with axillary clearance to drain removal at either 3 or 6 days postoperatively. More seroma fluid was collected in the group

whose drain was left *in situ* longer, but no difference in the volume, number, or duration of percutaneous aspirations was observed once the drain was removed. Inwang et al. (76) randomized 84 patients to drain removal on day 5 to drain removal when drainage was less than 20 mL over 2 consecutive days and found no significant difference in the mean number of aspirations required, wound complications or cosmesis. Yii et al. (77) compared drains removed at 48 hours to a "standard" removal group. No significant difference in drainage at 48 hours and no significant difference in seroma frequency were observed. Liu and McFadden (78) removed drains at 23 hours postoperatively in 50 patients who underwent axillary lymphadenectomy. Only a 2% seroma rate was observed, as 49 out of the 50 patients had no symptomatic seroma. Thus, there appears to be good evidence in favor of early drain removal.

PATIENT FACTORS

Although a number of surgical technique-related factors have been described to play a role in seroma formation, most patient and tumor-related factors have been shown consistently to have no significant association with seroma formation. A number of studies have attempted to associate patient and tumour characteristics to postoperative seroma formation. Body weight and body mass index (79, 80) are associated with increased seroma formation, whereas no consistent association has been found between seroma formation and hormone receptor status, axillary nodal status, lymph node positivity or disease stage and grade. Similarly, no consistent association has been found between seroma formation and the presence of anemia, smoking, diabetes mellitus, or breast size. Tumor size and location, histological type, site of the disease and specimen weight are not associated with increased seroma formation (81).

METHODOLOGY

SOURCE OF DATA:

This is a prospective study comprising 80 patients of carcinoma breast over a period of six months from March 2016 to August 2016. 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 80 cases

Patients with odd in-patient no underwent Modified Radical Mastectomy with conventional simple wound closure.

Patient with even in-patient no. underwent Modified Radical Mastectomy with obliteration of dead space by Flap fixation.

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:

Patients with carcinoma breast undergoing breast conservation surgery

Patients with carcinoma breast undergoing radiotherapy

Patients with carcinoma breast undergoing modified radical mastectomy after neo-adjuvant chemotherapy

Patients with carcinoma breast undergoing palliative surgery/toilet mastectomy

Patients with carcinoma breast undergoing completion mastectomy

Patients not consented for inclusion in the study

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.

The patients were followed for three weeks in post-operative period,

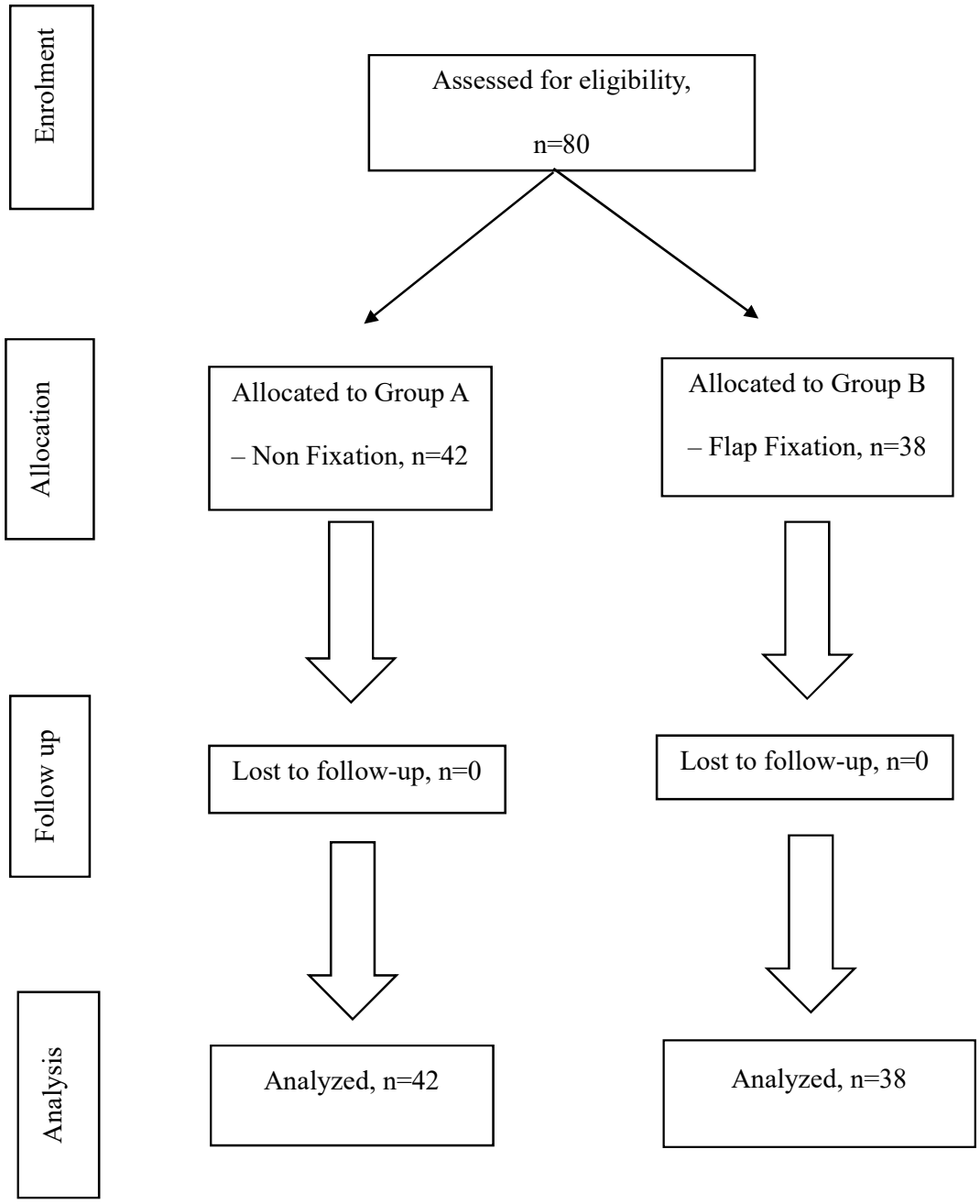
Day 1 drain volume, total drain volume, drain removal day, seroma and wound complication were all recorded.

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 wo groups were compared and analyzed by using Chi-square test.

CONSORT DIAGRAM



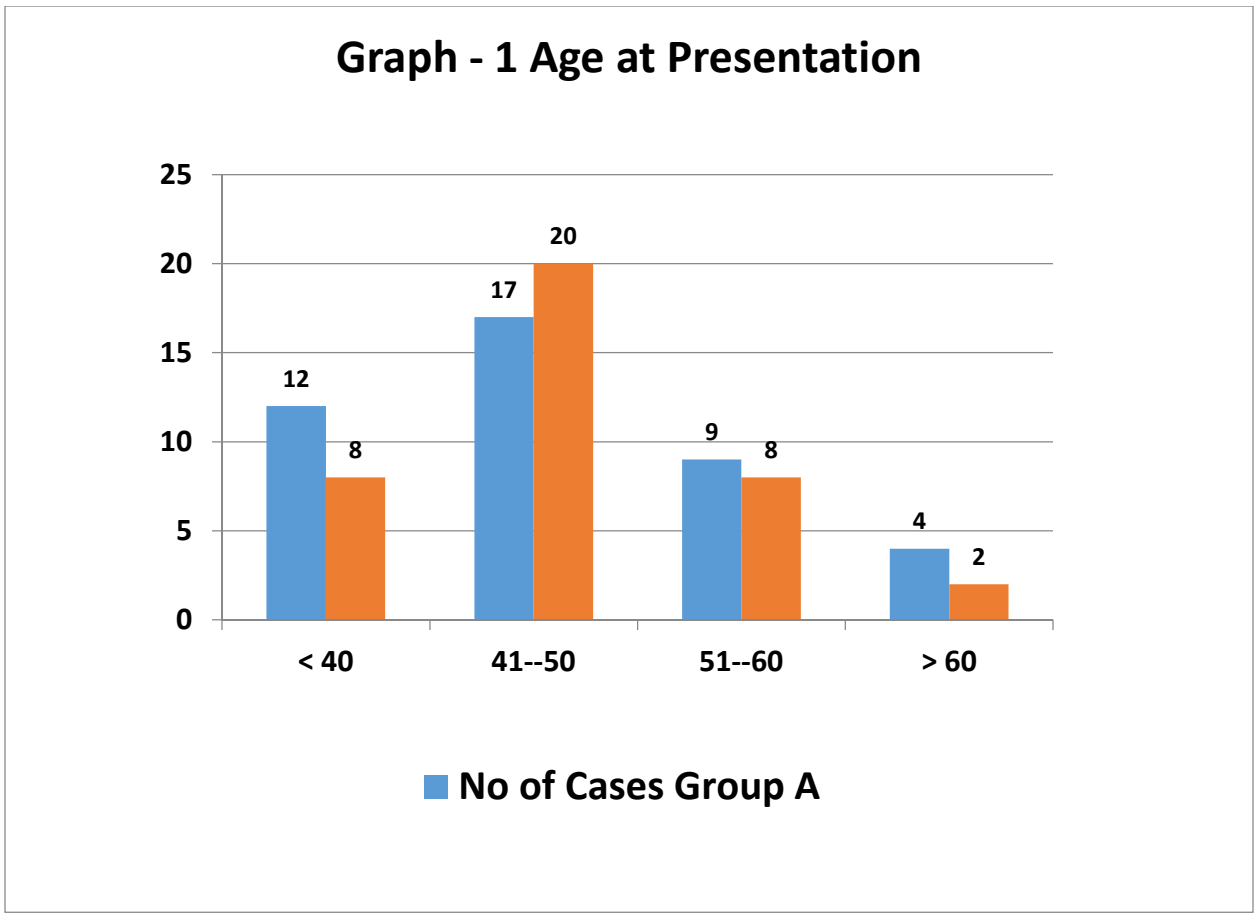
RESULTS AND OBSERVATION

In this "Prospective study on efficacy of mechanical obliteration of dead space following axillary clearance for carcinoma breast in reducing the incidence of seroma formation" conducted in Department of General Surgery at Government Rajaji Hospital, Madurai from March 2016 to August 2016, a total of 80 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. 42 patients with odd IP no in conventional simple wound closure (Group A) and 38 patients with even IP no in Flap fixation (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=42	Group B (%) n=38
≤40	20	25	12 (28)	8 (21)
41-50	37	46	17 (40)	20 (52)
51-60	17	21	9 (21)	8 (21)
>60	6	7	4 (9)	2 (5)



In this study, age of the patients were more than 18 years. The youngest patient included in this study series was 30 years, and the eldest was 69 years old. Almost 46% of the patients were in 41-50 age group. This includes 40% in group A and 52% in group B.

Average age in this study series is 47 years.

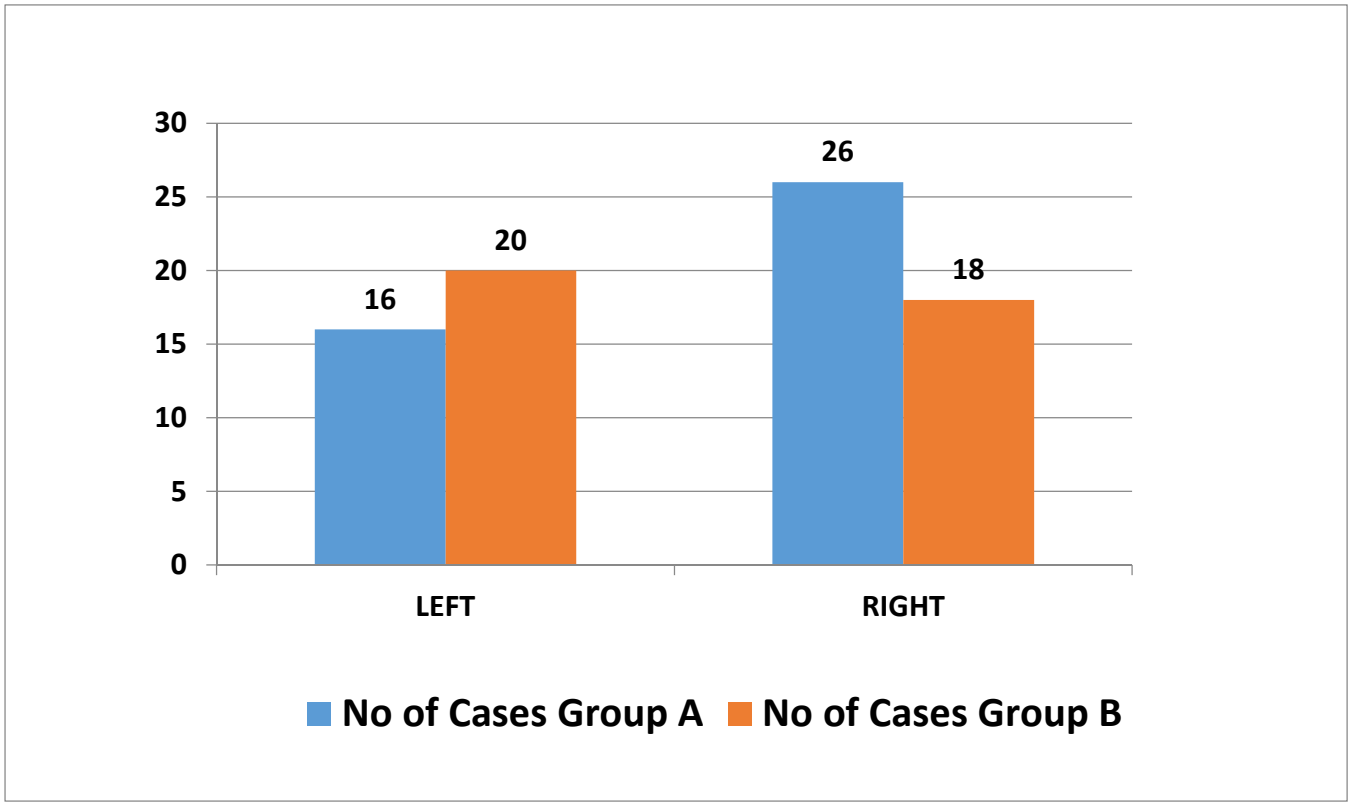
LOCATION OF THE TUMOR

Table – 2. Location of the Tumor

Side	No of Patients		Percentage %
	Group A	Group B	
Right	26	18	55
Left	16	20	45

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

Graph – 2. Location of Tumor



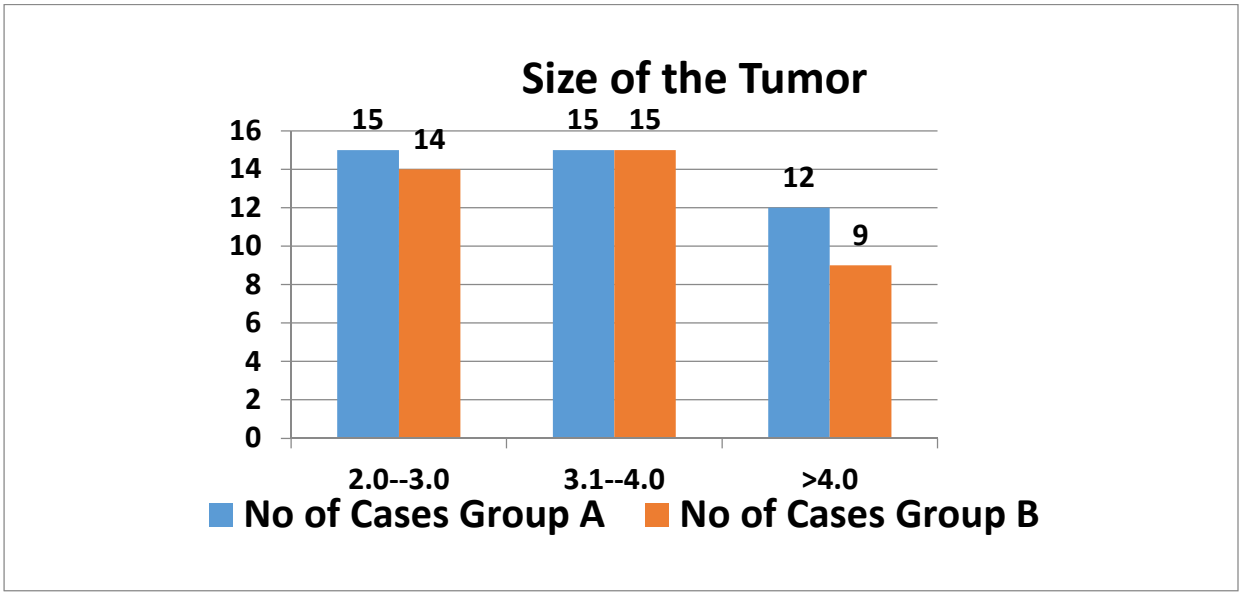
SIZE OF THE TUMOR

Table – 3. Size of the Tumor

Size in cm	No. of Patients		Total
	Group A	Group B	
2.0 – 3.0	15	14	29
3.0 – 4.0	15	15	30
4.0 – 5.0	12	9	21

In the study, the size of tumor at presentation varied from 2cm to 4.8cm with average size being 3.4cm.

Graph – 3. Size of the Tumor



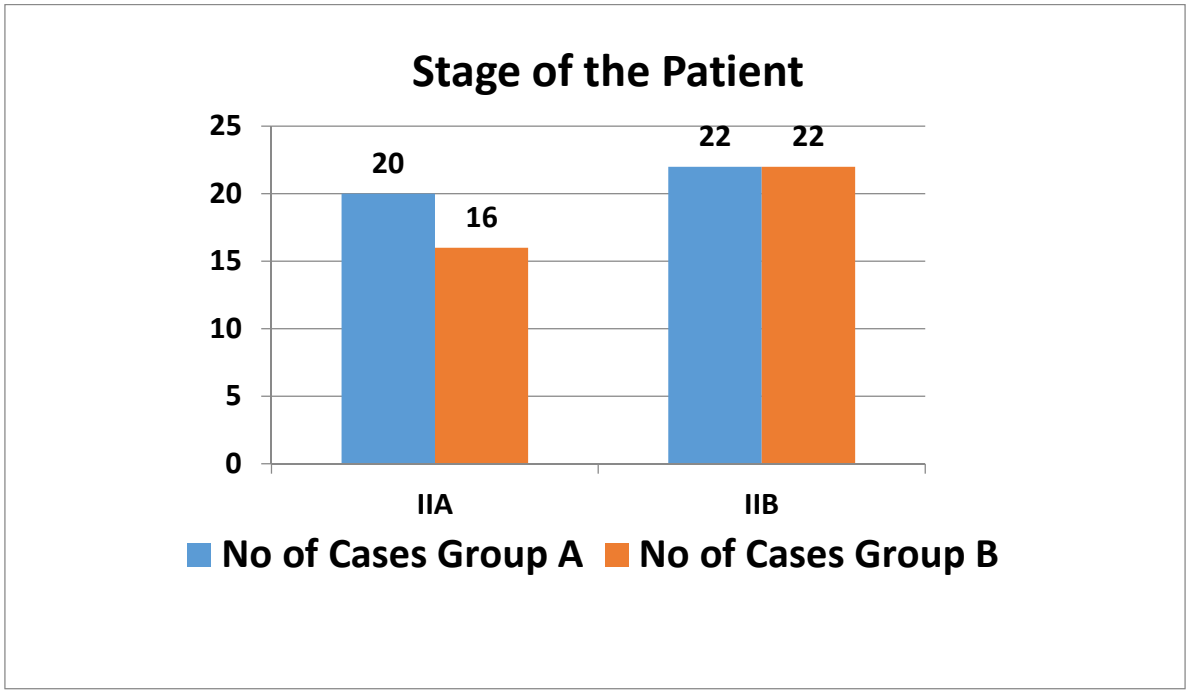
STAGE OF THE PATIENT

Table – 4. Stage of the patient

Stage	No. of Patients		Total
	Group A	Group B	
IIA	20	16	36
IIB	22	22	44

In the study, 36 women presented with Stage IIA disease and 44 women presented with stage IIB disease.

Graph – 4. Stage of the Patient



COMPARISION OF STUDY GROUPS

Table – 5. Comparison of study groups

Comparison of	**Flap Non Fixation** **Group A (n=42) (%)**	**Flap Fixation** **Group B (n=38) (%)**
1. Demography		
Mean Age	48±9	46±7
2. Location		
Right	26 (62)	18 (47)
Left	16 (38)	20 (52)
3. Tumor Size		
Mean Tumor Size	3.46	3.43
4. Stage of the Patient		
IIA	20 (47)	16 (42)
IIB	22 (52)	22 (58)

In the present study, modified radical mastectomy with conventional simple wound closure was performed in 42 women with mean age 48±9 years.

Of the 42 women, 26 (62%) had Right sided breast carcinoma and 16 (38%) had left sided breast carcinoma.

Average size of the tumor at presentation was 3.46±0.8 cm.

Of the 42 women, 20 (47%) women belonged to stage IIA at presentation and 22 (52%) women belonged to stage IIB.

Modified radical mastectomy and wound closure with flap fixation was performed in 38 women with mean age 46±7 years.

Of the 38 women, 18 (47%) had Right sided breast carcinoma and 20 (52%) had left sided breast carcinoma.

Average size of the tumor at presentation was 3.43±0.8 cm.

Of the 38 women, 16 (42%) women belonged to stage IIA at presentation and 22 (57%) women belonged to stage IIB.

POST-OPERATIVE FOLLOW UP

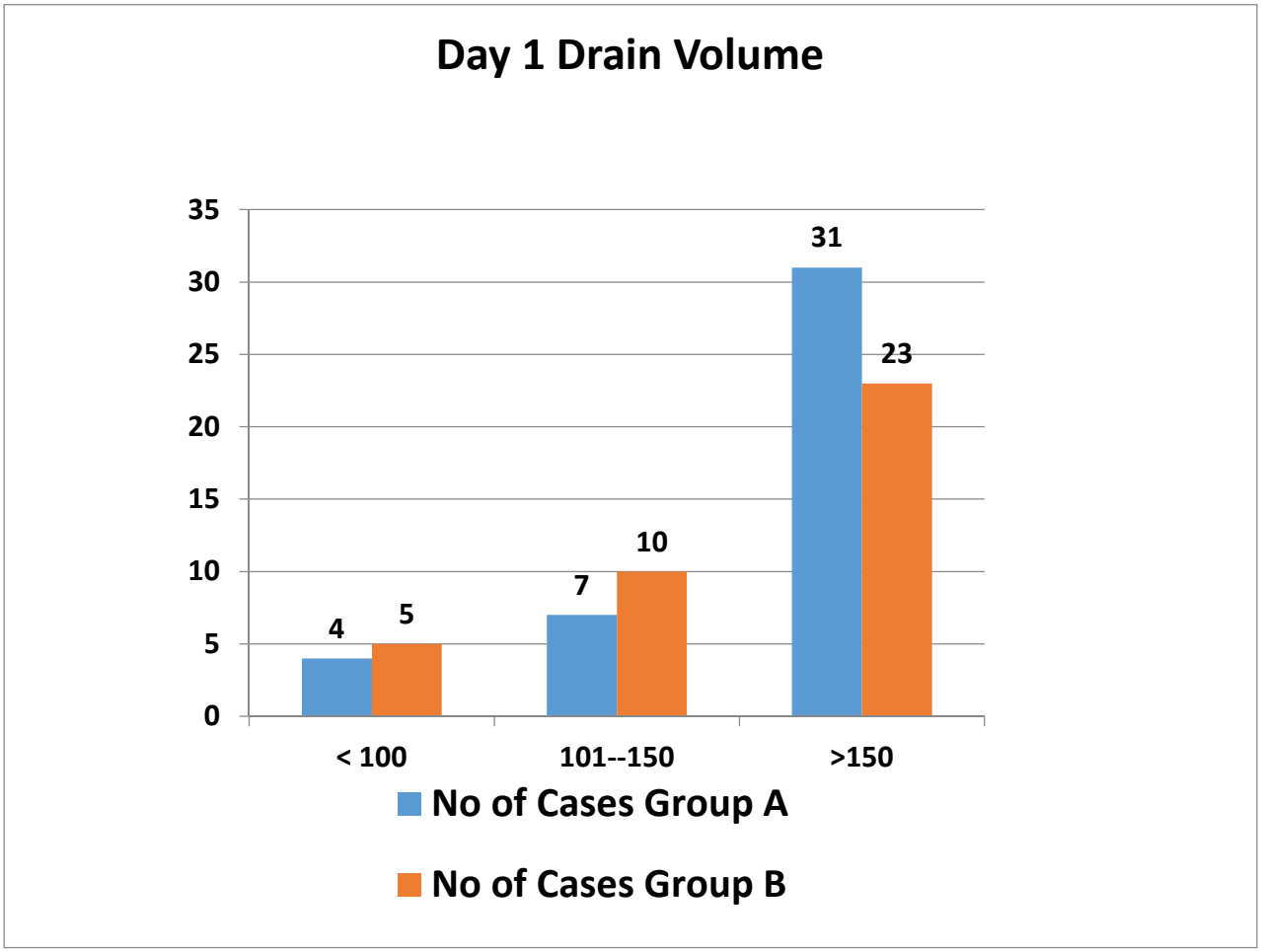
Post-operative drain volume on day 1, total drain volume, day of drain removal, seroma formation and wound complications has been compared between two groups (A&B). The results were compared with p value using Chi Square test.

Table – 6. Day 1 Drain Volume

Day 1 Drain Volume (ml)	No of Patients		Total
	Group A	Group B	
<100	4	5	9
100-150	7	10	17
>150	31	23	54
Mean Volume (ml)	170.2	163.8	
p'value=0.41 NS			

In the present study, the drain volume in first post-operative day in Group A (Flap Non Fixation) was compared with Group B (Flap Fixation) after Modified radical mastectomy. Drain volume in first post-operative day varied from 100 to 200ml with average of 170ml in group A and 163ml in group B. There was no statistically significant difference in the drain volume in first post-operative day ($p>0.05$).

Graph – 6. Day 1 Drain Volume



Total Drain Volume

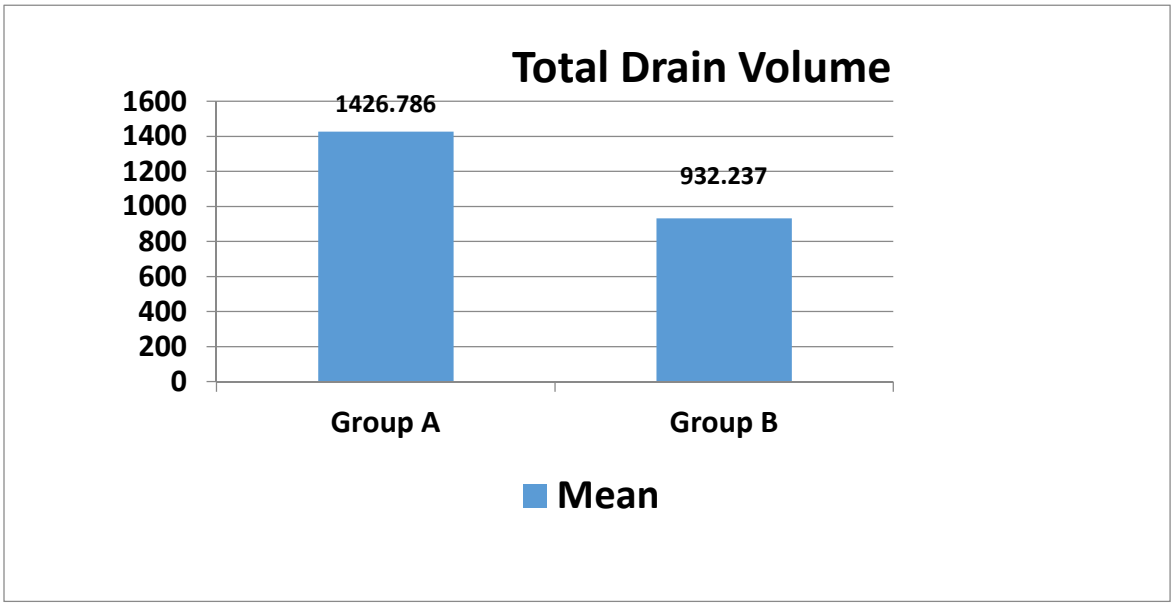
Table – 7. Total Drain Volume

	Mean Total Volume (ml)	SD
Group A	1426	240
Group B	932	216
p'value<0.001 S		

In the present study, the total drain volume in the post-operative period in Group A was compared with Group B.

The average total drain volume in the post-operative period in group A was 1426ml and 932ml in group B. p value was found to be significant (<0.001).

Graph – 7. Total Drain Volume



Drain Removal Day

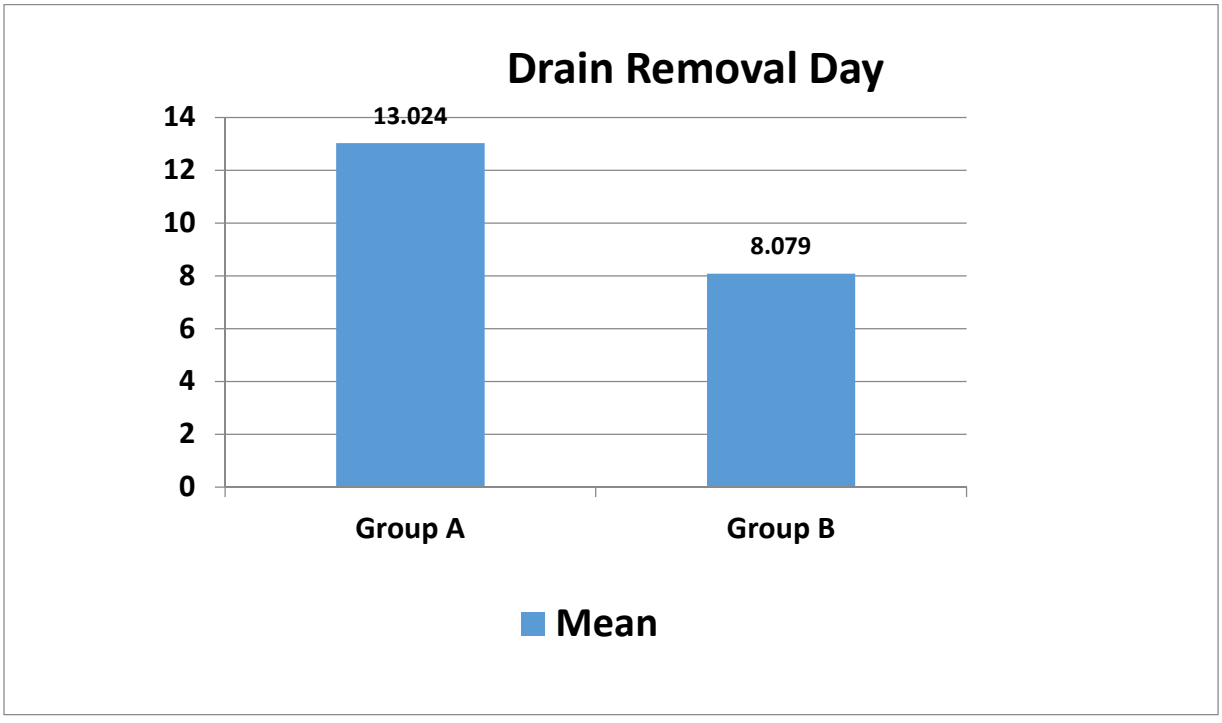
Table – 8. Drain Removal Day

	Mean Day of Removal	SD
Group A	13	2.3
Group B	8	1.6
p'value<0.001 S		

In the present study, drain removal day in Group A was compared with Group B.

The average day of drain removal in group A was 13 days and 8 days in group B. p value was found to be significant (<0.001).

Graph – 8. Drain Removal Day



Incidence of Seroma

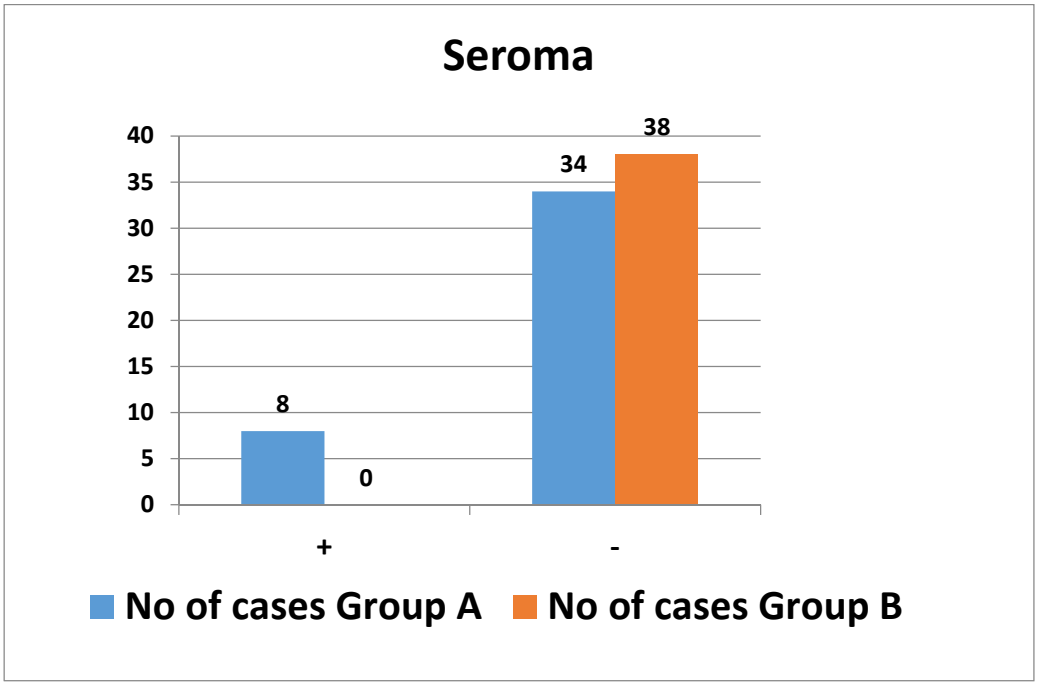
Table – 9. Incidence of Seroma

Seroma	Group A	Group B	Total
Present	8	0	8
Absent	34	38	72
p'value=0.027 S			

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

8 patients developed seroma in group A vs none in group B. p value was found to be significant (>0.05).

Graph – 9. Incidence of Seroma



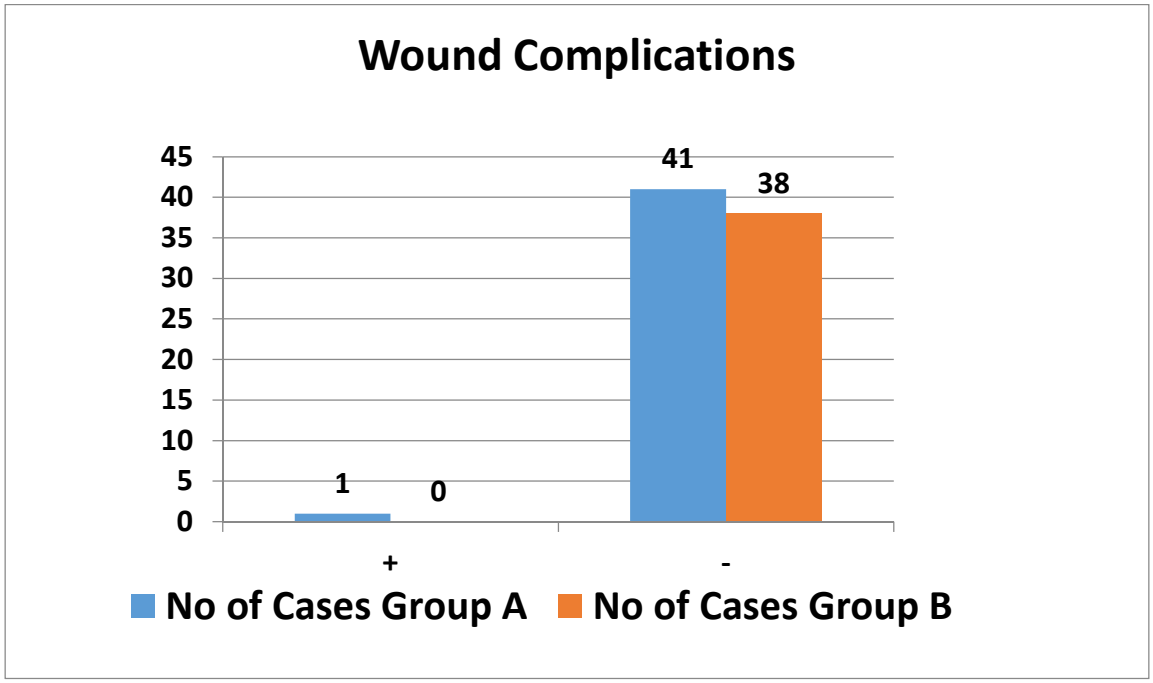
Wound Complications

Table – 10. Incidence of Wound Complications

Wound Complications	Group A	Group B	Total
Present	1	0	1
Absent	41	38	79
p'value=0.95 NS			

In the present study, wound complications in Group A was compared with Group B. One patient developed wound complication (cellulitis) vs none in group B. There was no statistically significant difference in the incidence of wound complications in both groups

Graph – 10. Incidence of Wound Complications



DISCUSSION

Seroma is a significant problem following axillary dissection for breast cancer, which is now considered as sequelae rather than complication.

Mechanical obliteration of dead space by flap fixation in an attempt to reduce incidence of seroma formation has been proposed by many studies with inconsistent results. So the present study was undertaken to evaluate the effect of mechanical obliteration of dead space by flap fixation in reducing incidence of seroma formation.

In this study, 80 women with Breast cancer, who underwent modified radical mastectomy, were evaluated for total drain volume, drain removal time, seroma formation and wound complications in two study groups (group A – 42 women, and group B – 38 women).

There were no significant differences between the two groups with regard to age, stage, and tumor size.

In group A, 42 women who underwent modified radical mastectomy had their wound closed in two layers – subcutaneous tissue with 2/0 vicryl and skin with 2/0 ethilon.

In group B, 38 women who underwent modified radical mastectomy had their wound closed by fixation of skin flap to underlying pectoralis major muscle with multiple rows of intermittent 2/0 vicryl followed by skin closure with 2/0 ethilon.

In all the patients, 2 14F suction drain were kept in axilla and in front of pectoral muscles. Drain volume on first post-operative day was recorded. Drain was removed when the output was less than 30ml for 24 hours. Total drain volume was recorded. The patients were followed for three weeks. The patients who developed seroma by clinical examination were recorded. Wound was observed for any complications like infection, cellulitis, and necrosis.

In the present study we found that the flap-fixation technique significantly decreased the drainage period ($P < 0.001$; significant), which agrees with the results of Inwang *et al. (76).*

Our mean number of days for drain removal was 8 days in the flap-fixation group versus 13 days in the no-flap-fixation group; this disagrees with the results of Kopelman *et al*., (82) who said that most surgeons remove the drain when the drainage volume is less than 50 ml in the preceding 24 h, which usually takes about 10 days if the flap-fixation technique is not used.

In the present study, we found that the flap-fixation technique significantly decreased the total amount of fluid drained ($P < 0.001$; highly significant), which agrees with the results of Alaa Eldin *et al., (83).*

The mean amount of serous fluid drained was 932 ml in the flap-fixation group versus 1426 ml in the no-flap-fixation group, whereas the mean amount of serous fluid drained was 262.2 ml in the flap-fixation group versus 763.5 ml in the no-flap-fixation group in the study conducted by Natalie *et al*. This may be due to the fewer number of patients in their study.

The overall clinical incidence of seroma in the whole study was about 10% (8/80). Woodworth *et al*. (44) reported that the incidence of seroma fell within the range of 10-81%, and this agrees with our result.

Our study showed that the flap-fixation technique was associated with no incidence of clinically symptomatic seroma (0%) after mastectomy, as compared with the control group (19%), with *P* value less than 0.001, which was highly significant. Purushotham et al. (85) also found that flap fixation was useful in decreasing seroma formation after drain removal.

In our study, one patients developed cellulitis in the no flap-fixation technique vs none in flap fixation technique, which was treated medically and improved later on.

Flap fixation obliterates the dead space and reduces the incidence of seroma formation probably by decreasing movement of flap over the chest wall and therby reducing the exudate.

CONCLUSION

In the present study, 80 women have completed the study protocol. Of this 42 women in group A (Flap non fixation) and 38 women in group B (Flap fixation) underwent modified radical mastectomy.

After analyzing the data and observations,

The present prospective study demonstrated that the mechanical obliteration of dead space by flap fixation significantly decreases the incidence of seroma 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.

Although the study sample is small in this present study, it is still wise to recommend mechanical obliteration of dead space by flap fixation in patients undergoing modified radical mastectomy. So when performing modified radical mastectomy, the flap-fixation technique is a valuable technique for reducing seroma formation allowing early drain removal and increased patient satisfaction.

SUMMARY

"Prospective study on efficacy of mechanical obliteration of dead space following axillary clearance for carcinoma breast in reducing the incidence of seroma formation" Conducted in department of general surgery at government rajaji hospital, Madurai from march 2016 to august 2016.

- Data collected in a prescribed proforma, analyzed and evaluated for day 1 drain volume, total drain volume, seroma formation and wound complications.
- Sample size was 80 women in two groups, group A - 42 (Flap non fixation) and group B – 38 (Flap fixation). All 80 women completed study protocol.
- Of the 80 women, 42 women with mean age 48$\pm$8 years belongs to group A and 38 women with mean age 46$\pm$7 years belongs to group B.
- Average size of the tumor at presentation was 3.4cm.
- 36 (45%) women presented with stage IIA disease and 44 (55%) with stage IIB disease.
- Drain volume in first post-operative day varied from 100 to 200ml with average of 170ml in group A and 163ml in group B. There was no statistically significant difference in the drain volume in first post-operative day ($p>0.05$).
- The average total drain volume in the post-operative period in group A was 1426ml and 932ml in group B. p value was found to be significant (<0.001).
- The average day of drain removal in group A was 13 days and 8 days in group B. p value was found to be significant (<0.001).
- 8 patients developed seroma in group A vs none in group B. p value was found to be significant (>0.05).

- One patient developed wound complication (cellulitis) vs none in group B. There was no statistically significant difference in the incidence of wound complications in both groups
- The present prospective study demonstrated that the mechanical obliteration of dead space by flap fixation significantly decreases the incidence of seroma 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 on efficacy of mechanical obliteration of dead space following axillary clearance for carcinoma breast in reducing the incidence of seroma formation"

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

SYSTEMIC EXAMINATION

- Cardiovascular system
- Respiratory System
- Central nervous system
- Genito - urinary system
- Abdomen:
- DRE: sphincter tone/ palpable mass
- 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:

Wound closure: Flap fixation done/not done

Post - operative instructions: All the patients in the study group were advised to start arm exercises from post-operative day 2

Post - operative period:

First day drain volume

Total drainage volume

Drain removal time

Seroma & Wound complications.

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

TUMOR SIZE: In cm

STAGE: AJCC TNM staging

MRM: Modified Radical Mastectomy

WOUND CLOSURE: A: flap non fixation group B: Flap fixation group

DRAIN DAY 1: Drain volume in post-operative day 1 in ml

TOTAL VOLUME: Total drain volume in ml

REMOVED DAY: Date of drain removal

SEROMA: + present, - absent

WOUND COMPLICATION: + present, - absent

MASTER CHART

SL.NO	NAME	AGE	SEX	IP NO	SIDE	TUMOR SIZE	STAGE	PROCEDURE	WOUND CLOSURE	DRAIN DAY 1	TOTAL VOLUME	REMOVED DAY	SEROMA	WOUND COMPLI
1	SHANTHA	40	F	1094477	LT	2.5	IIA	MRM	A	200	975	14	–	–
2	LAKSHMI	45	F	1099854	LT	3.9	IIA	MRM	B	100	1125	11	–	–
3	RADHIKA	42	F	1104350	RT	4	IIB	MRM	B	200	800	8	–	–
4	VASANTHI	37	F	1107069	RT	4.3	IIA	MRM	A	150	1250	9	–	–
5	SHANTHI	50	F	1111418	RT	4.5	IIB	MRM	B	175	1200	10	–	–
6	ANITHA	31	F	1112917	LT	3.9	IIB	MRM	A	175	1625	15	–	–
7	FOUSIA BANU	38	F	1117661	LT	2.5	IIB	MRM	A	200	1225	13	–	–
8	INDRANI	50	F	1121996	RT	2	IIA	MRM	B	200	550	6	–	–
9	JOTHI	62	F	1137023	RT	2	IIA	MRM	A	150	1650	11	+	–
10	MUNIYAMMAL	52	F	1140381	RT	4.4	IIA	MRM	A	75	1375	15	–	–
11	ALAGAMMAL	50	F	48443	RT	4.5	IIB	MRM	A	175	1500	13	–	–
12	CHANDRA	46	F	1115802	RT	2.8	IIA	MRM	B	150	1125	11	–	–
13	MUTHUMARI	50	F	1117486	LT	3.1	IIB	MRM	B	125	875	7	–	–
14	ESTHER	55	F	1117412	RT	3.6	IIB	MRM	B	175	575	6	–	–
15	SELVAMANI	40	F	1120595	RT	2.8	IIA	MRM	A	200	1625	14	–	–
16	LAKSHAKODI	44	F	1130553	LT	3.2	IIB	MRM	A	175	1450	16	+	–
17	SELVI	36	F	1131986	RT	4	IIB	MRM	B	150	750	9	–	–
18	BHAGAVAHI DEVI	50	F	1135907	RT	3.4	IIB	MRM	A	200	1650	14	–	+
19	VEERA BOOPATHI	50	F	1139749	RT	3.1	IIA	MRM	A	175	1125	10	–	–
20	MUTHAMMAL	55	F	1092984	RT	2.8	IIA	MRM	B	200	825	8	–	–
21	VIJAYA	57	F	1110011	RT	4	IIA	MRM	A	175	725	12	–	–
22	RAJIYA	65	F	1101392	LT	2.8	IIA	MRM	B	175	700	10	–	–
23	BOOMA DEVI	62	F	1101477	RT	4.6	IIB	MRM	A	100	1475	9	–	–
24	SANTHA	48	F	1098096	LT	2.5	IIA	MRM	B	200	1025	9	–	–
25	KRISHNAMMAL	55	F	1109679	RT	4	IIB	MRM	A	175	1325	13	+	–
26	THANGAVANAM	55	F	1112382	RT	2	IIA	MRM	B	175	950	8	–	–
27	CHELLAMMAL	45	F	1115986	LT	4.8	IIB	MRM	B	75	625	7	–	–
28	VASANTHA	69	F	49335	LT	4.1	IIA	MRM	A	200	1750	15	–	–
29	VIMALA	47	F	1135390	RT	4	IIB	MRM	B	150	750	8	–	–
30	KAMILAISA	60	F	1140717	RT	3.5	IIB	MRM	A	175	1575	14	–	–
31	AZHAGURANI	39	F	1098919	LT	2.2	IIA	MRM	A	200	1525	15	–	–
32	MUMTAZ	39	F	1105556	RT	3.6	IIB	MRM	B	175	1175	6	–	–
33	SUBBULAKHSMI	39	F	1107623	RT	2.4	IIB	MRM	A	200	1475	15	–	–
34	LATHA	47	F	1125003	RT	3.6	IIB	MRM	A	175	1600	16	+	–
35	RAHMATH BEEVI	40	F	1126671	RT	4	IIA	MRM	A	200	975	12	–	–
36	ESWARI	40	F	1128328	LT	4.2	IIB	MRM	B	100	925	7	–	–
37	VICTORIA	62	F	1131181	RT	4.5	IIB	MRM	A	175	1250	15	–	–
38	MUMTAJ	45	F	1127643	RT	4.2	IIA	MRM	A	100	1325	13	–	–
39	LAKSHMI	38	F	1139912	RT	2.4	IIA	MRM	B	200	1100	11	–	–
40	SARASWATHI	47	F	1105357	LT	2.2	IIA	MRM	A	175	1675	14	–	–

SL.NO	NAME	AGE	SEX	IP NO	SIDE	TUMOR SIZE	STAGE	PROCEDURE	WOUND CLOSURE	DRAIN DAY 1	TOTAL VOLUME	REMOVED DAY	SEROMA	WOUND COMPLI
41	BANUREKHA	30	F	1104953	RT	2	IIA	MRM	A	175	1425	11	–	–
42	KAMAYEE	50	F	1084513	RT	4.2	IIB	MRM	A	200	1550	8	–	–
43	ANDICHI	40	F	1116674	LT	3.2	IIA	MRM	B	200	1450	8	–	–
44	TAMILARASI	45	F	1122573	LT	2.4	IIB	MRM	A	175	1925	16	+	–
45	SHANHI	41	F	1129852	LT	2.4	IIA	MRM	B	150	950	9	–	–
46	YASODHAI	45	F	1099242	RT	3.7	IIB	MRM	B	175	700	6	–	–
47	ERULAYEE	45	F	1105064	LT	2.5	IIA	MRM	B	200	775	9	–	–
48	GHANTHIDEVI	45	F	1104578	RT	2.3	IIA	MRM	B	175	650	8	–	–
49	VALLI	60	F	1104137	RT	2.3	IIA	MRM	A	200	1350	13	–	–
50	JEYACHITRA	36	F	1112260	LT	2.6	IIA	MRM	B	75	1175	10	–	–
51	SUMATHY	40	F	1111264	LT	3.4	IIB	MRM	B	150	1125	7	–	–
52	JOTHI	35	F	1116114	LT	4.8	IIB	MRM	B	200	950	9	–	–
53	AMMAPILLAI	56	F	1125358	LT	4.2	IIB	MRM	B	150	875	6	–	–
54	PANDI	40	F	57301	LT	3.5	IIA	MRM	A	150	1650	16	–	–
55	VIJAYA	58	F	57994	LT	3	IIA	MRM	B	200	1150	7	–	–
56	RAJATHI	45	F	1134179	RT	2.8	IIA	MRM	A	75	1125	11	–	–
57	CHIDAMBARAM	60	F	58409	LT	3.9	IIA	MRM	A	200	1550	14	–	–
58	PEELAMMAL	46	F	1086943	RT	3.7	IIB	MRM	A	175	1700	15	–	–
59	MALLIKA	57	F	1094649	LT	2.8	IIA	MRM	A	200	1375	9	–	–
60	NAGAMMAL	45	F	1106879	LT	4.8	IIB	MRM	A	125	1525	10	–	–
61	AVUDAITHANGAM	40	F	1114271	LT	3.9	IIB	MRM	A	200	1675	13	–	–
62	REVATHI	43	F	1117798	LT	3.4	IIB	MRM	B	175	675	9	–	–
63	PANCHAVARNAM	48	F	1116426	RT	3.5	IIB	MRM	B	200	1100	11	–	–
64	VENIRADHA	43	F	1118552	RT	3.9	IIB	MRM	B	175	875	8	–	–
65	JOTHIMANI	62	F	1129794	LT	4.5	IIB	MRM	B	150	925	6	–	–
66	ESTHER	55	F	57564	RT	4.2	IIB	MRM	B	125	1125	8	–	–
67	IRULAYEE	52	F	1095473	RT	4	IIB	MRM	A	175	975	10	–	–
68	DEVI	39	F	1115811	RT	2.8	IIA	MRM	A	150	1550	16	–	–
69	MURUGAYEE	58	F	1117222	LT	4.4	IIB	MRM	B	175	1075	7	–	–
70	SHANTHI	42	F	1118112	LT	4.7	IIB	MRM	B	200	725	6	–	–
71	MEENAKSHI	45	F	1119231	LT	2.7	IIA	MRM	A	175	1425	14	–	–
72	PANCHU	51	F	1119476	RT	2.2	IIA	MRM	B	175	675	7	–	–
73	NAGAMANI	43	F	1100928	LT	3.9	IIB	MRM	B	150	1200	10	–	–
74	CHINTHAMANI	46	F	1120913	LT	4.7	IIB	MRM	A	200	1325	12	–	–
75	PANDI DEVI	48	F	1120985	RT	3.6	IIB	MRM	A	175	1300	11	–	–
76	KARUPAYEE	59	F	1121005	RT	4.2	IIB	MRM	A	200	1525	16	–	–
77	RANI MARY	46	F	1121083	LT	4.6	IIB	MRM	A	125	1475	15	–	–
78	FATHIMA	42	F	1123402	LT	2.7	IIA	MRM	B	200	1150	8	–	–
79	NAGU	46	F	1121432	RT	4	IIB	MRM	B	100	1025	6	–	–
80	POTHUMPONNU	48	F	1137081	RT	2.7	IIB	MRM	A	150	1375	10	–	–