FCS PRIMARY TUTORIAL

Anatomy of the breast and basics of mastectomy

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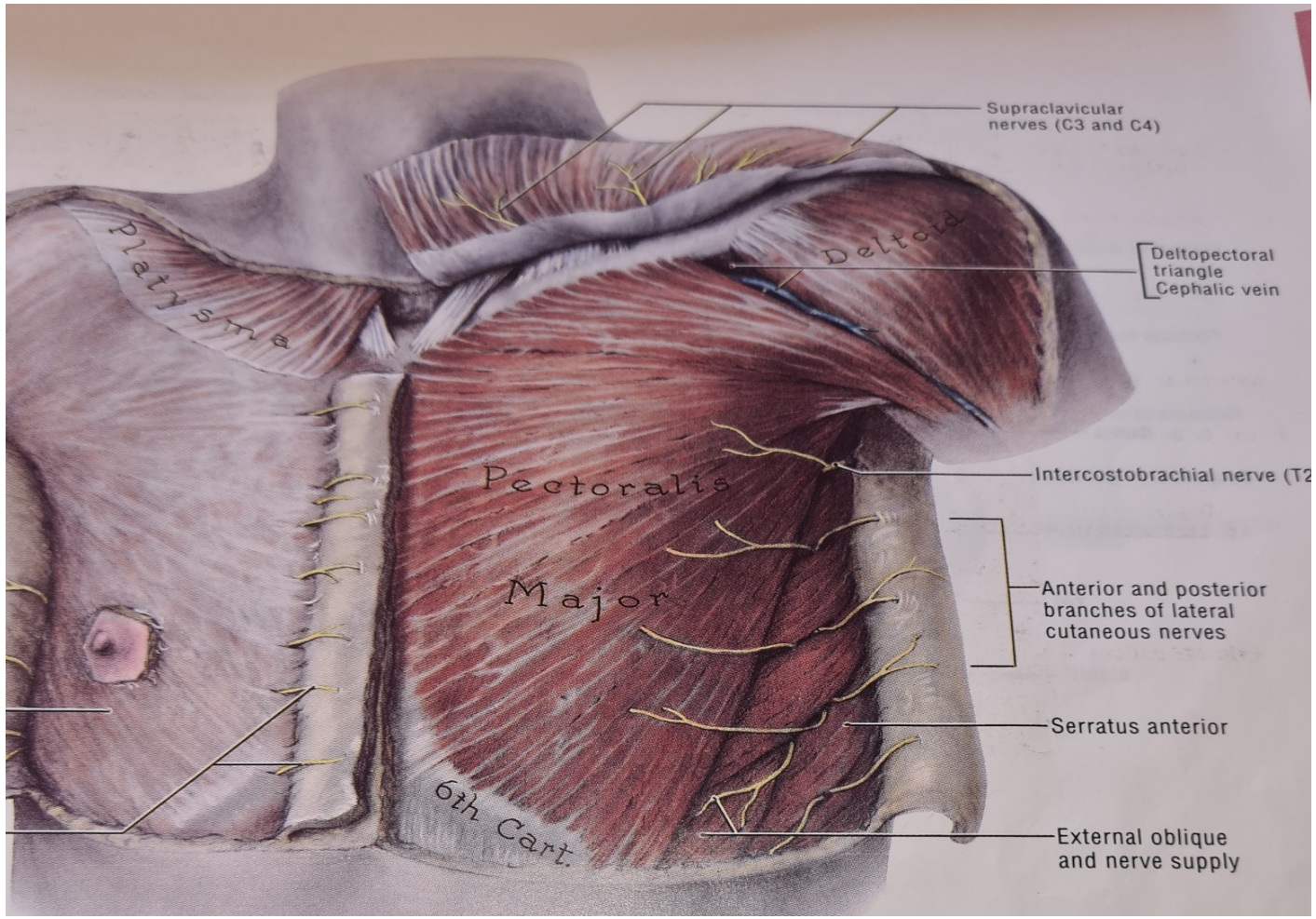
Anatomy

- A modified sweat gland
- Mature breast extends from the 2$^{nd\ or\ 3rd}$ to 6$^{th\ or\ 7th}$ rib[inframammary fold]
- Medially to lateral border of sternum
- Laterally to the anterior or mid axillary line
- NB axillary tail of Spence
- Thin sliver of tissue: subclavius muscle/ clavicle, superiorly
  2- 3cm below inframammary fold, inferiorly
  middle of sternum[midline], medially
  anterior border of latissimus dorsi, laterally

Posterior surface rests on fascia of pectoralis major, serratus anterior, external oblique muscles , and a portion of the rectus sheath



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2/3 of the breast rests on pectoralis major muscle fascia and 1/3 on serratus anterior muscle fascia

Anomaly: 1 in 20 cadavers

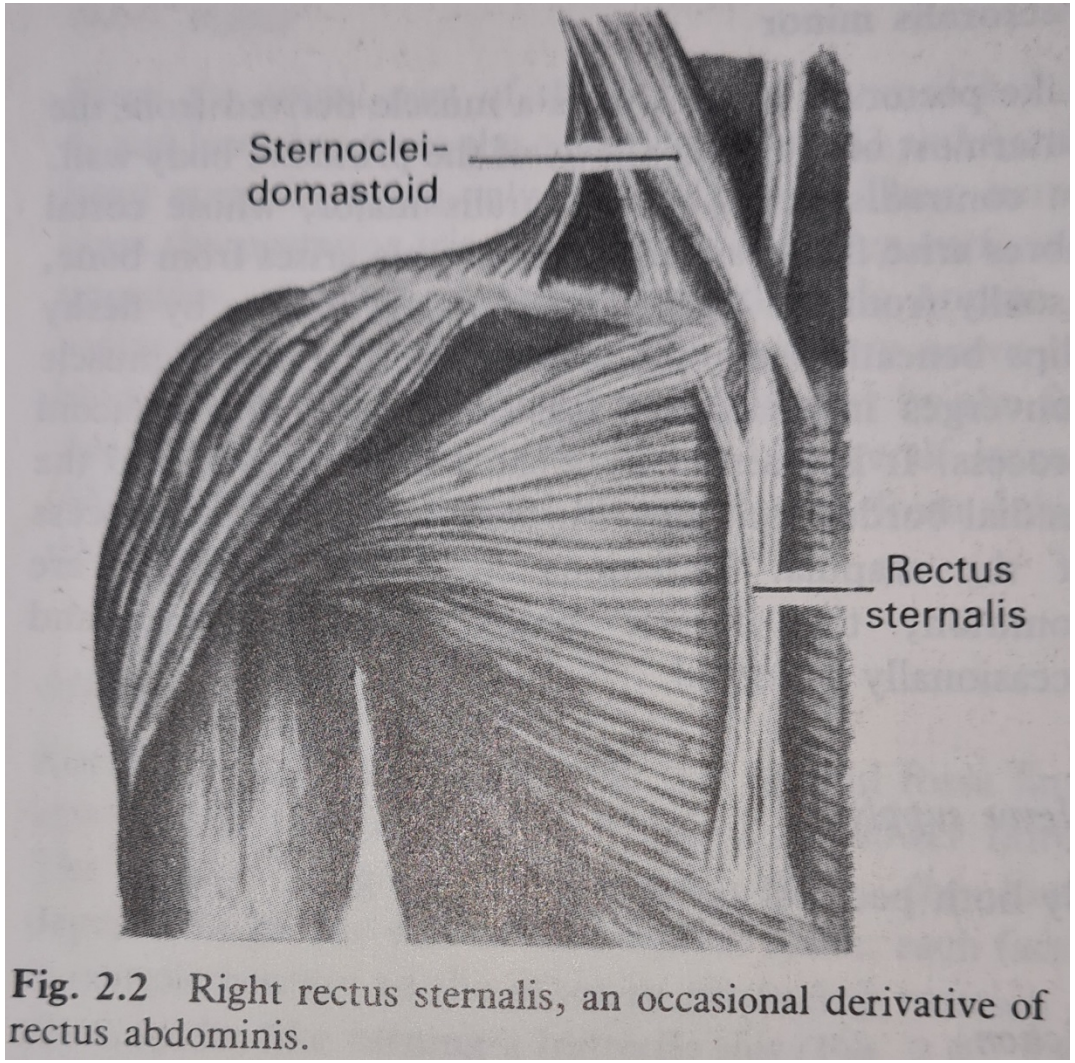

Fig. 2.2 Right rectus sternalis, an occasional derivative of rectus abdominis.

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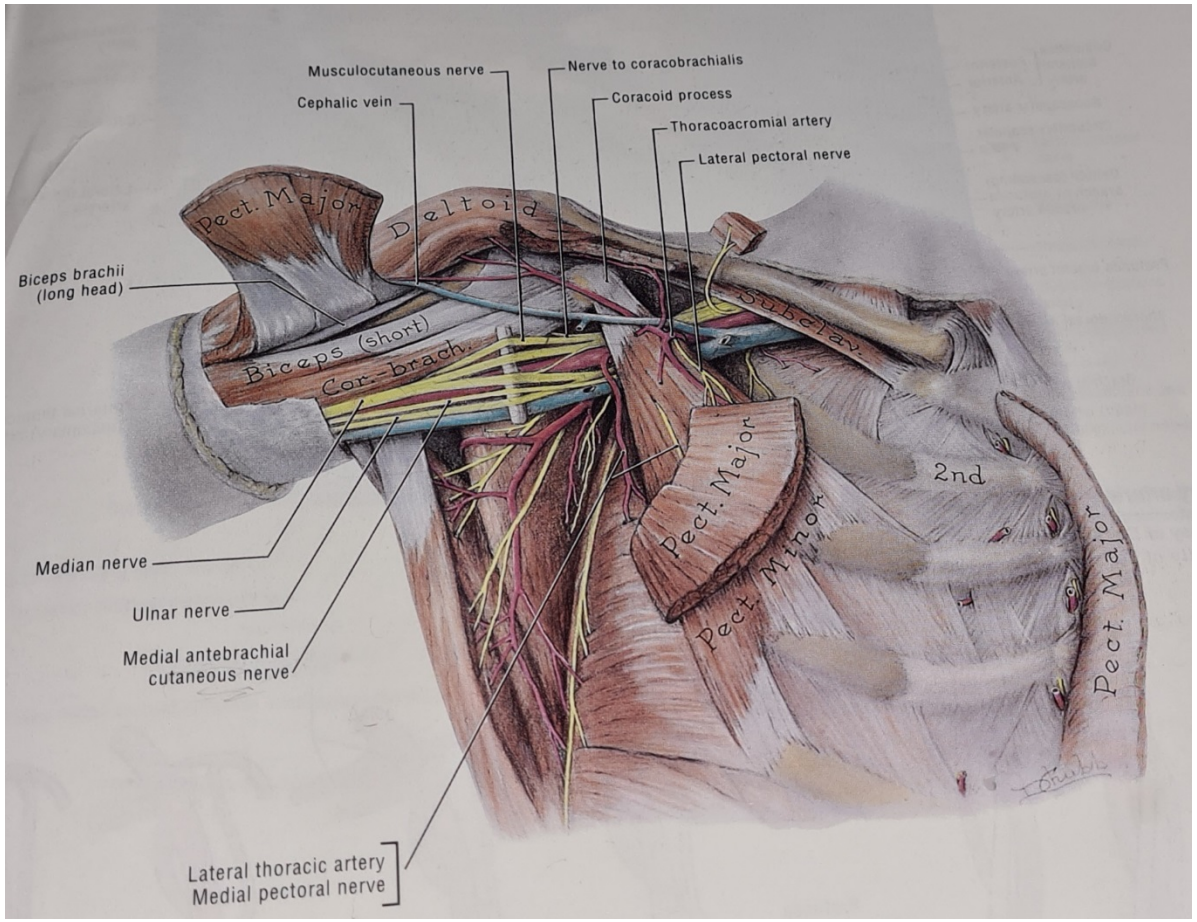

Relationship of pectoralis major muscle to pectoralis minor and serratus anterior muscles

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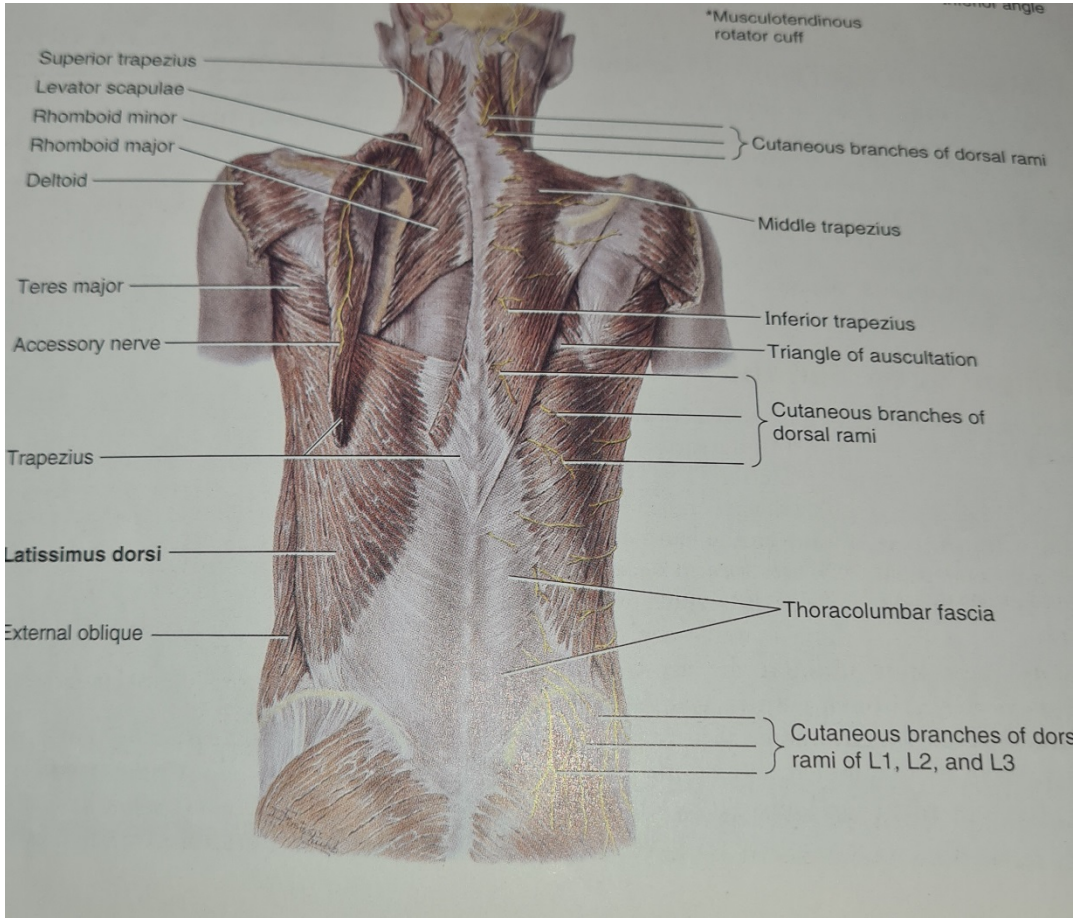

Origin of latissimus dorsi muscle

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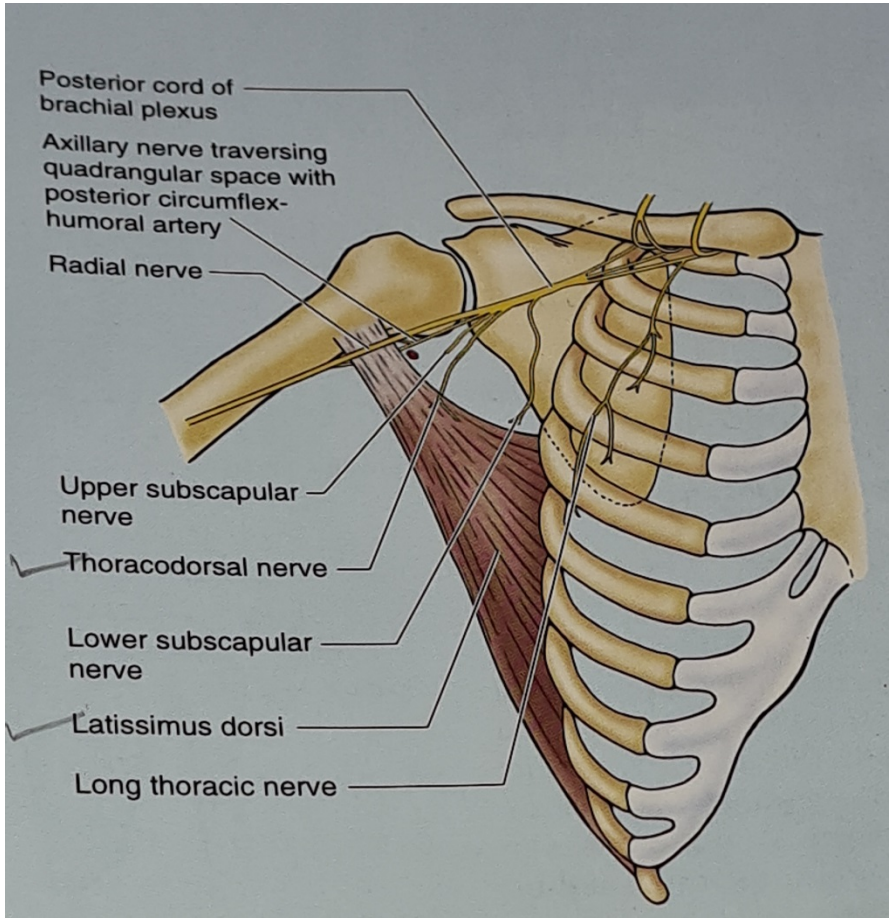

Insertion of latissimus dorsi muscle

Grant's Atlas of Anatomy: 9th Edition

Keith L. Moore, Arthur F. Dalley. Clinically orientated Anatomy . 4th Edition

Muscle	Proximal Attachment	Distal attachment	Innervation	Main Action
Pectoralis major	Clavicular head: anterior surface of medial half of clavicle. Sternocostal head: anterior surface of sternum, superior six costal cartilages, and aponeurosis of external oblique muscle.	Lateral lip of intertubular groove of humerus.	Lateral and medical pectoral nerves; clavicular head (C5 and C6), sternocostal head (C7, C8 and T1).	Adducts and medially rotates humerus; draws scapula anteriorly and interiorly. Acting alone: clavicular head flexes humerus and sternocostal head extends it.
Pectoralis minor	3rd to 5th ribs near their costal cartilages.	Medial border and superior surface of coracoid process of scapula.	Medial pectoral nerve (C8 and T1)	Stabilizes scapula by drawing it inferiorly and anteriorly against thoracic wall.
Subclavius	Junction of 1st rib and its costal cartilage.	Interior surface of middle third of clavicle.	Nerve to subclavius (C5 and C6)	Anchors and depresses clavicle.
Serratus anterior	External surfaces of lateral parts of 1st to 8th ribs.	Anterior surface of medical border of scapula.	Long thoracic nerve (C5, C6 and C7).	Protracts scapula and holds it against thoracic wall; rotates scapula.

Muscle	Proximal Attachment	Distal Attachment	Innervation	Main Action
Trapezius	Medial 3rd of superior nuchal line; external occipital protuberance, nuchal ligament and spinous processes of C7-T12 vertebrae	Lateral 3rd of clavicle, acromion, and spine of scapula	Spinal root of accessory nerve (CN XI)[motor] and cervical nerves (C3and C4) for pain and proprioception	Elevates, retracts, and rotates scapula; superior fibers elevate, middle fibers retracts, and inferior fibers depress scapula; superior and inferior fibers work together in superior rotation of the scapula.
Latissimus dorsi	Spinous processes of inferior 6 thoracic vertebrae, thoracolumbar fascia, iliac crest, and inferior 3 or 4 ribs	Floor of intertubercular groove of humerus	Thoracodorsal nerve (C6, C7)	Extends, adducts, and medially rotates humerus; raises body toward arms during climbing

The brachial plexus

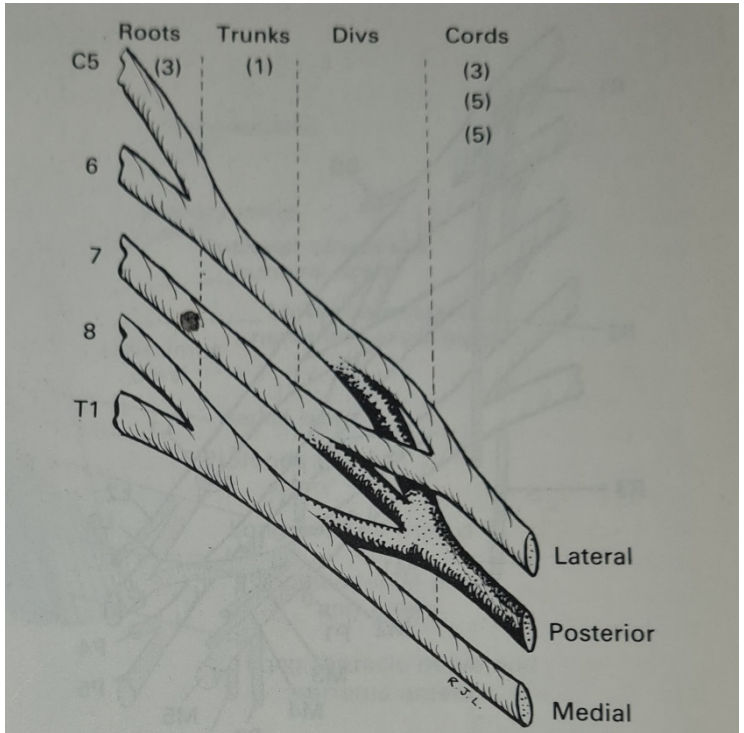

Fig. 2.13 Parts of the left brachial plexus. The anterior rami of C5–T1 nerves form the roots of the plexus (after giving off branches to the prevertebral muscles). The figures in brackets denote the numbers of branches from the constituent parts.

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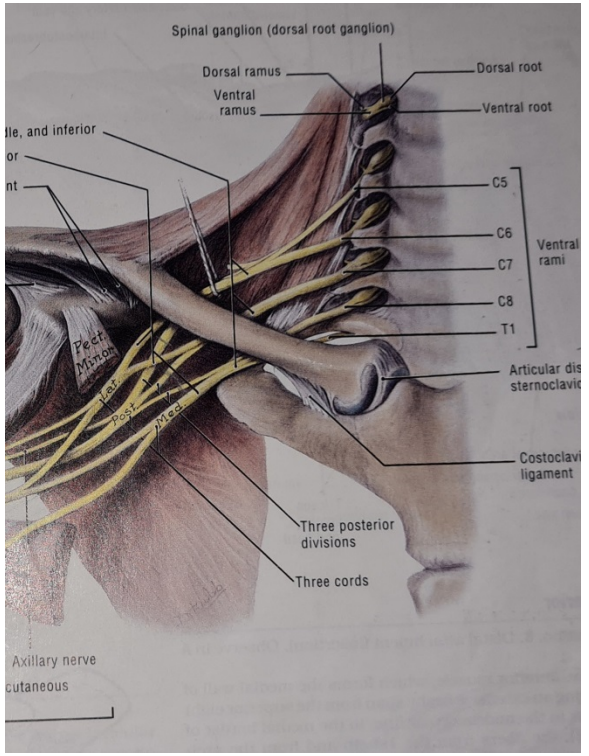
Brachial plexus

- Roots: behind scalenus anterior muscles
- Trunks: lower part of posterior triangle of the neck
- Divisions[into anterior and posterior]: behind the clavicle
- Cords: outer border of 1st rib[axilla]
- Branches[axilla]



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Anatomy: the brachial plexus

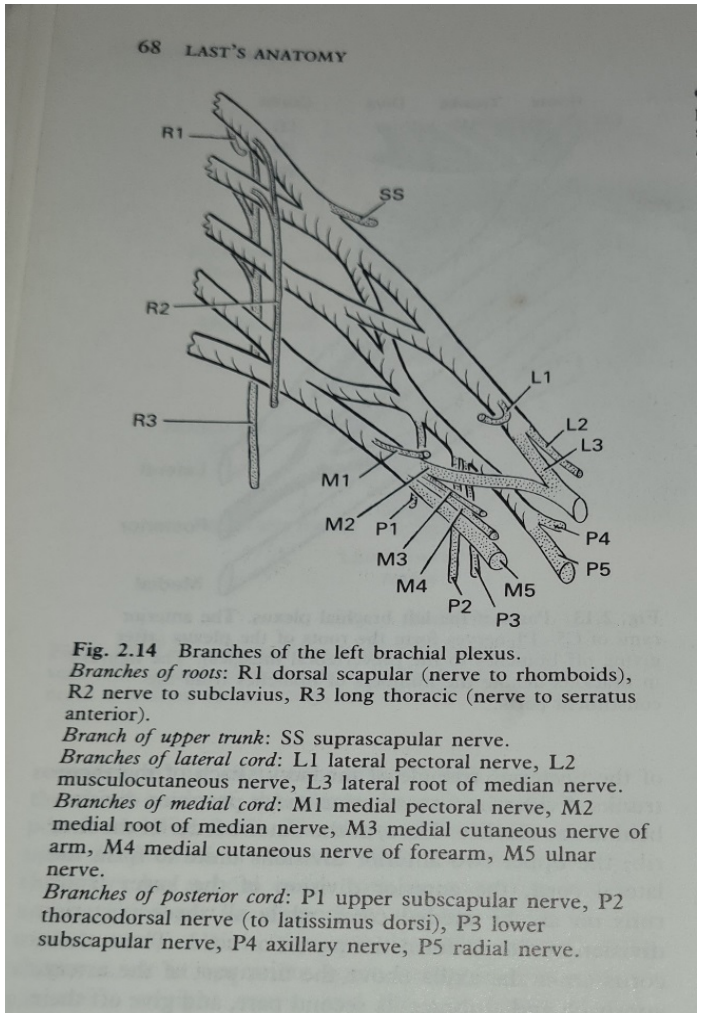

Fig. 2.14 Branches of the left brachial plexus.
Branches of roots: R1 dorsal scapular (nerve to rhomboids), R2 nerve to subclavius, R3 long thoracic (nerve to serratus anterior).
Branch of upper trunk: SS suprascapular nerve.
Branches of lateral cord: L1 lateral pectoral nerve, L2 musculocutaneous nerve, L3 lateral root of median nerve.
Branches of medial cord: M1 medial pectoral nerve, M2 medial root of median nerve, M3 medial cutaneous nerve of arm, M4 medial cutaneous nerve of forearm, M5 ulnar nerve.
Branches of posterior cord: P1 upper subscapular nerve, P2 thoracodorsal nerve (to latissimus dorsi), P3 lower subscapular nerve, P4 axillary nerve, P5 radial nerve.

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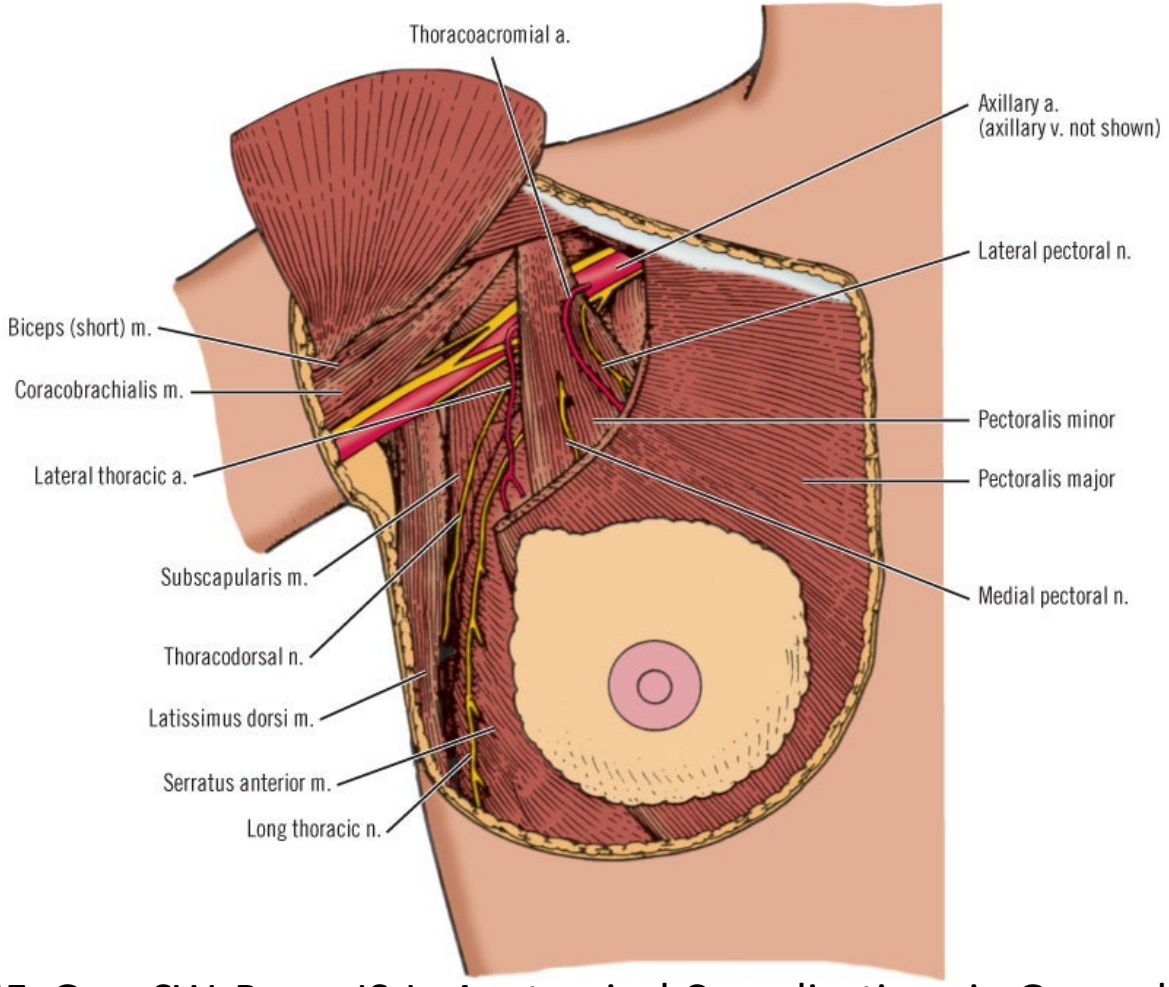
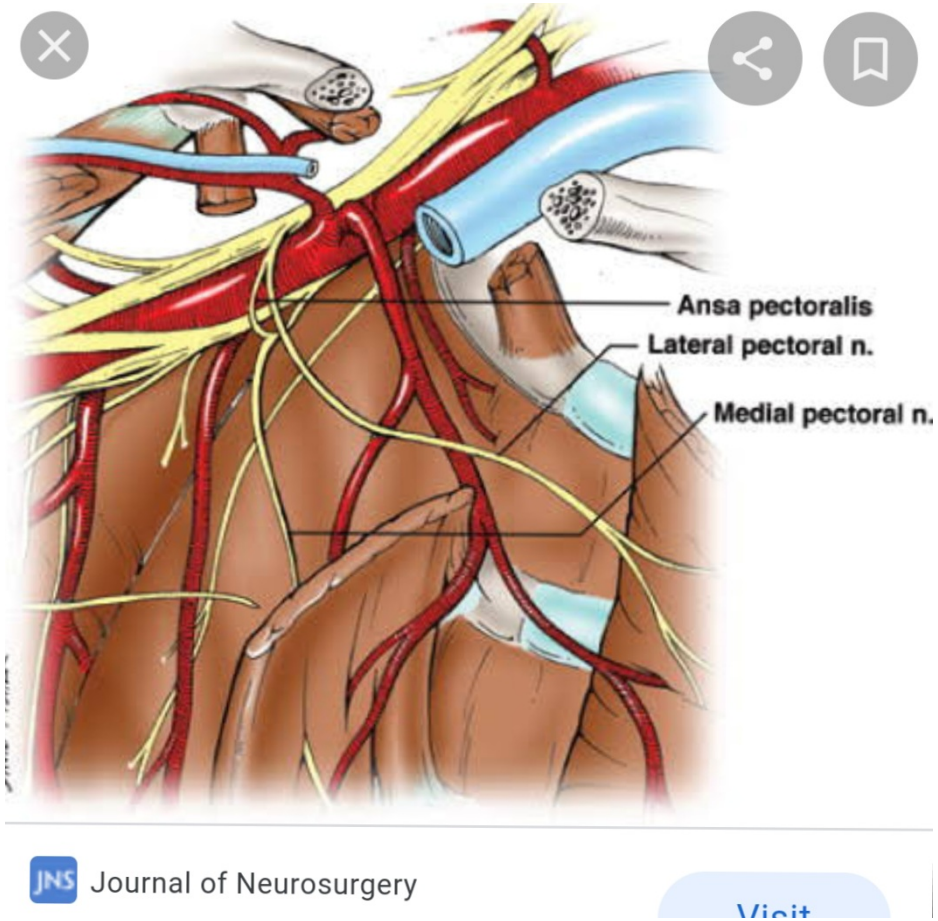


Relationship of medial and lateral pectoral nerves to each other and to pectoralis minor and major muscles.
Also note position of lateral thoracic artery to the lateral border of pectoralis minor.

Modified from Skandalakis JE, Gray SW, Rowe JS Jr. Anatomical Complications in General Surgery. New York: McGraw-Hill, 1983; with permission

Medial pectoral nerve[C8,T1] :medial cord

a. Enters the deep surface of pectoralis minor muscle[perforates muscle].Supplies pectoralis minor and lateral aspect of pectoralis major muscle.
b. Can sweep around the lateral aspect of pectoralis minor muscle[with the lateral thoracic artery].
c. These structures should be identified and preserved during axillary dissection.



Lateral pectoral nerve[C5,C6,C7]: lateral cord. Communicates with the medial pectoral nerve through ansa pectoralis.
Pierces the clavi-pectoral fascia.
Supplies pectoralis major muscle.

Both nerves play a major role in post- operative pain management: nerve block

The **long thoracic nerve** (nerve to serratus anterior) arises from the posterior aspects of C5, 6 and 7. Branches of C5 and 6 enter scalenus medius, unite in the muscle, emerge as a single trunk from its lateral border and pass down into the axilla. On the surface of serratus anterior (the medial wall of the axilla) this is joined by the branch from C7 which has descended in front of scalenus medius (Fig. 2.7). The nerve passes down posterior to the midaxillary line and supplies serratus anterior muscle segmentally (p. 60 and Fig. 2.15).

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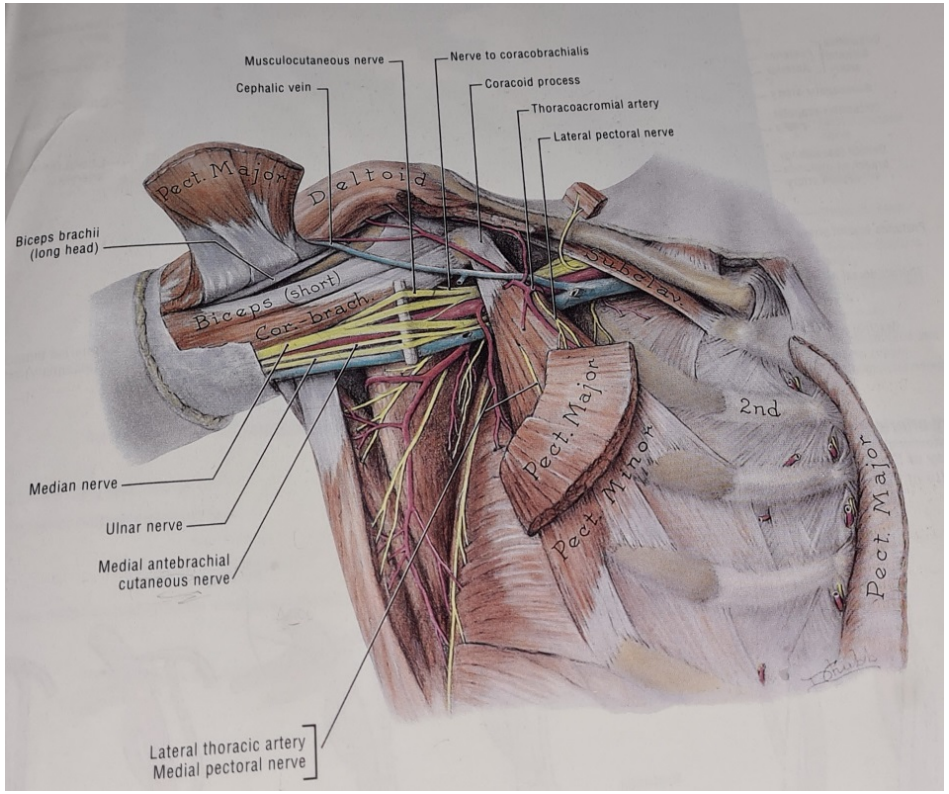


Long thoracic nerve on the surface of serratus anterior, lateral to lateral thoracic artery

- Inter-costo-brachial nerve: sensory, medial aspect of the arm

  > lateral cutaneous branch of 2^{nd} intercostal nerve± lateral cutaneous branch of 3^{rd} intercostal nerve

  > Crosses axilla to upper arm

- Thoracodorsal neve[C6,C7,C8], posterior cord

  > As it enters the axilla, it runs behind the axillary vein and subscapular artery > medial position.

➢ As it descends to enter the latissimus dorsi muscle, it lies in front of the artery [which at this level is called the thoracodorsal artery]

NB: injury>> atrophy latissimus dorsi muscles[musculocutaneous flap during reconstruction and function of the upper limb[shoulder].

A thoracodorsal to long thoracic nerve transfer[in case of injury to long thoracic nerve]

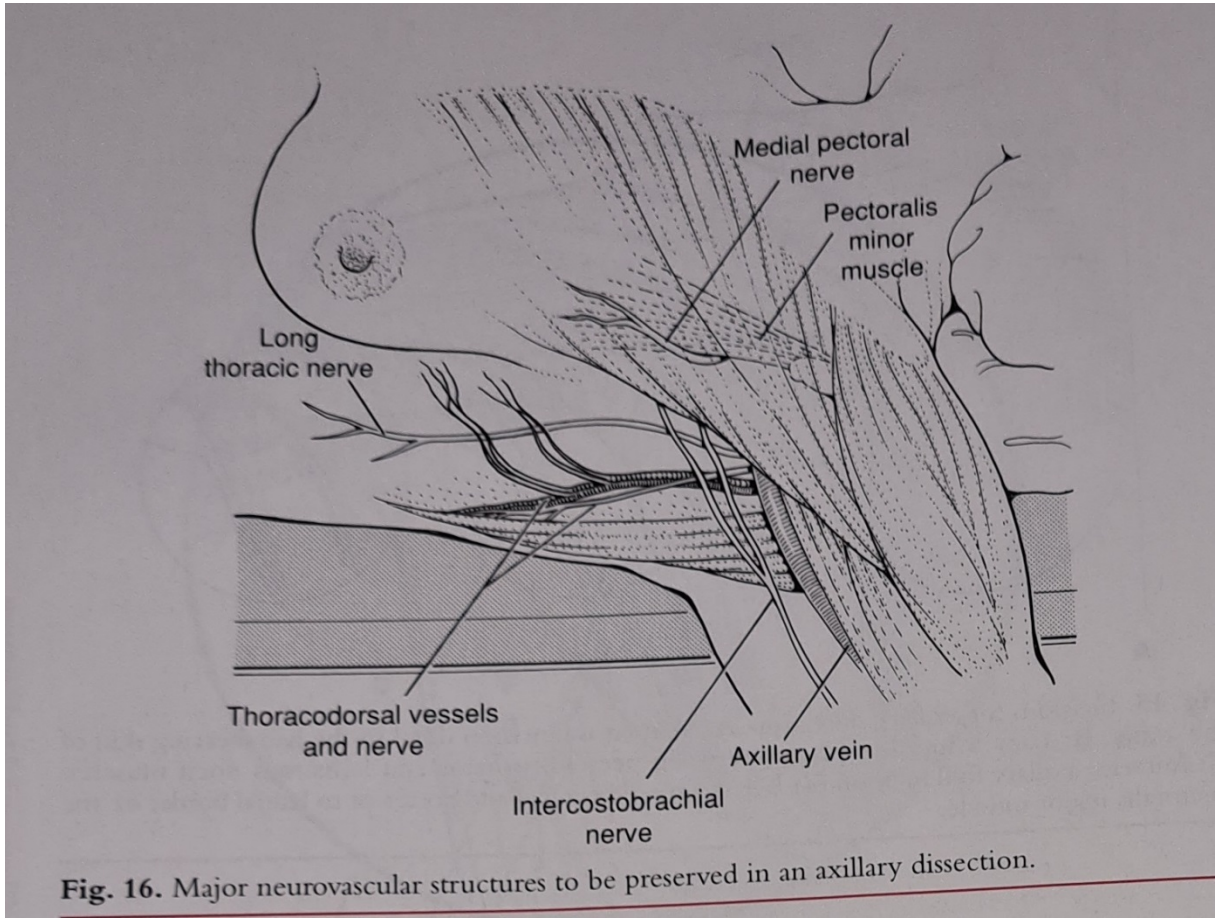
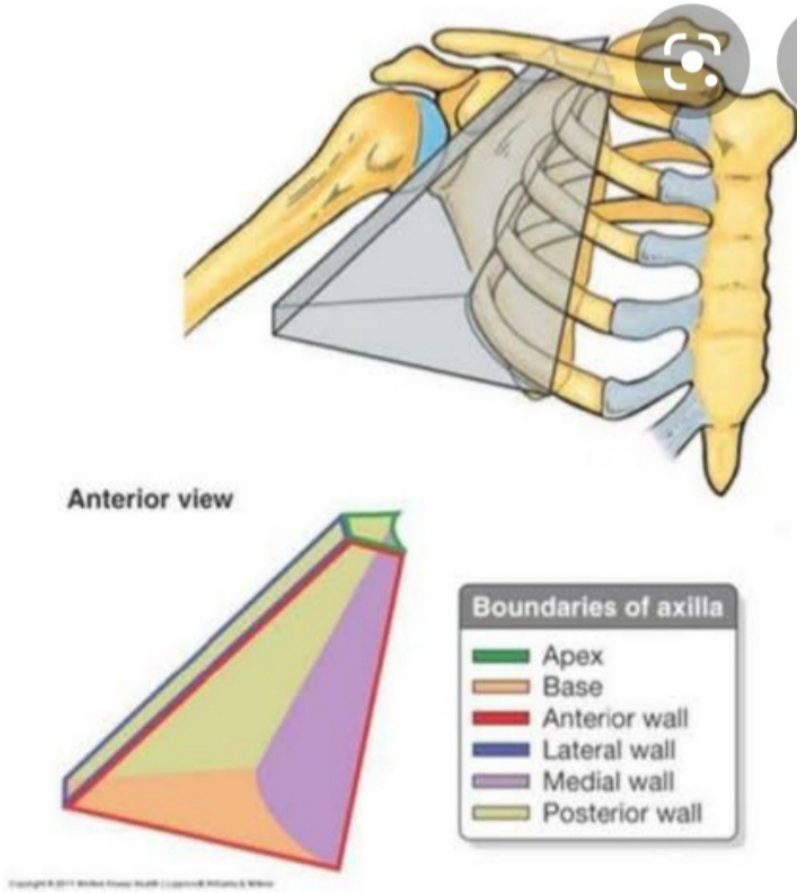


Fig. 16. Major neurovascular structures to be preserved in an axillary dissection.

Mastery of Surgery 5th Edition

Anatomy of the axilla



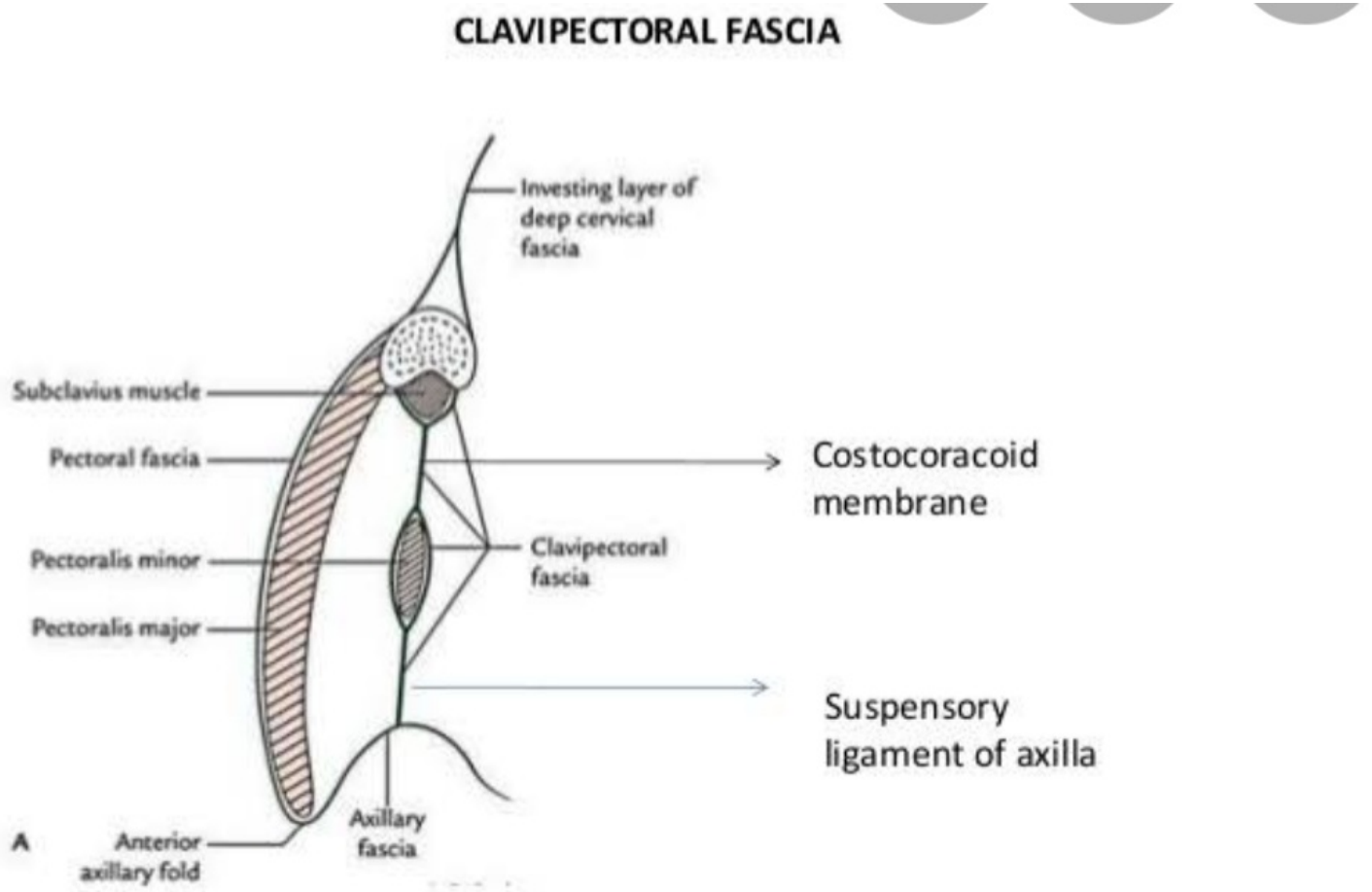
The axilla

- Pyramidal shaped
- Communicating with the posterior triangle of the neck via cervico-axillary canal
- Containing neurovascular structures , including lymph nodes
- Anterior axillary fold/wall: pectoralis major
  pectoralis minor
  subclavius
  clavi-pectoral fascia
- Posterior fold/wall: subscapularis
  teres major
  tendon of latissimus dorsi

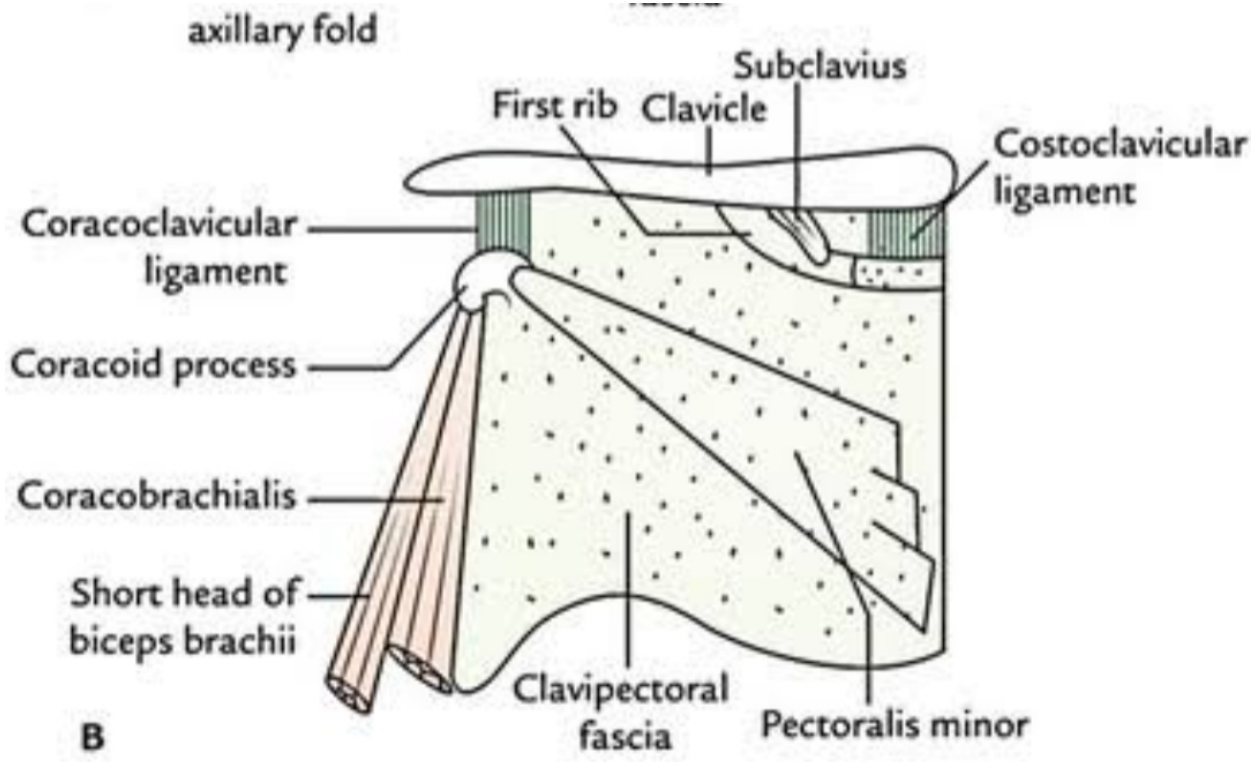
- Medial wall: upper part of serratus anterior
- Lateral wall; bicipital groove

- Apex, bounded by: clavicle[middle 3rd]
  scapular
  outer border of 1st rib
- Floor/base: axillary fascia[curved]

The clavi-pectoral fascia

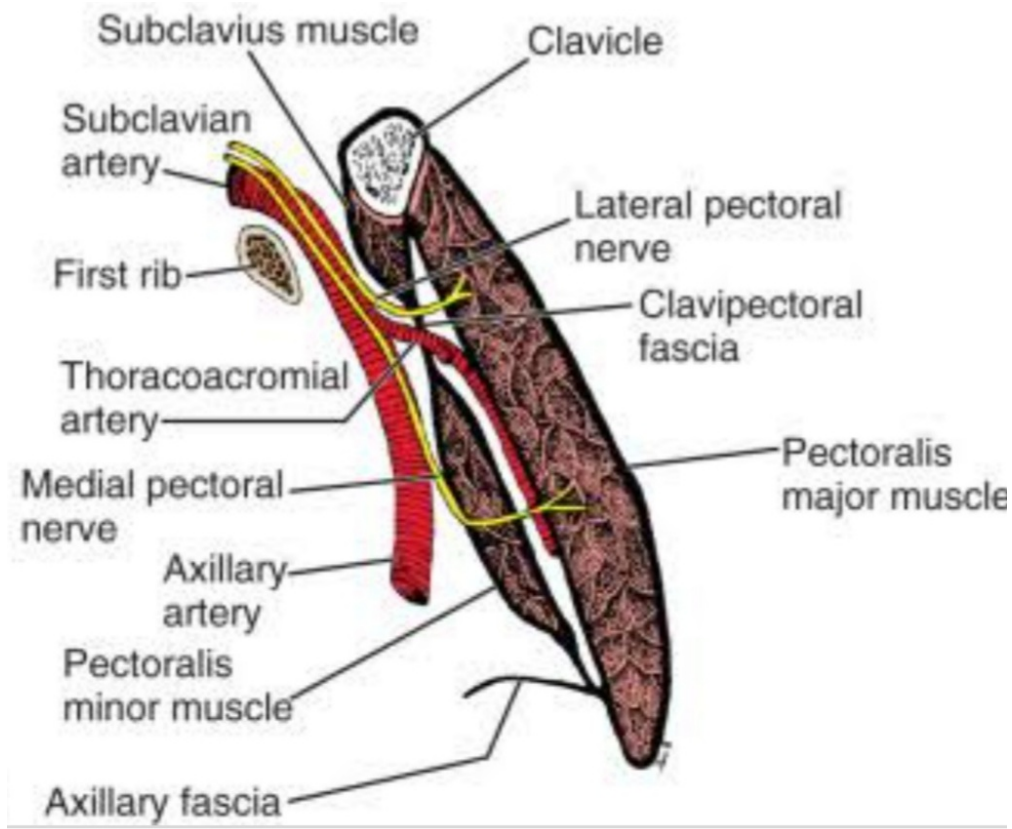


Clavi-pectoral fascia

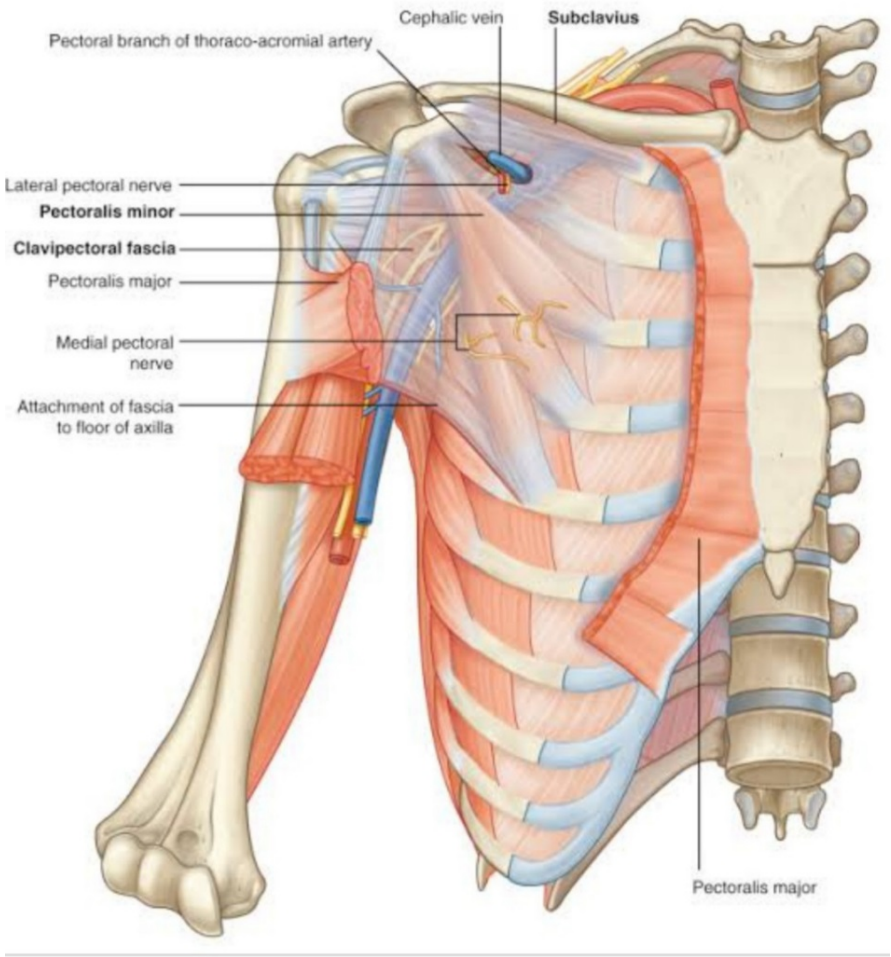


Earth's Lab

NB: Costo-clavicular ligament[medial extent of dissection for level III lymph nodes [not for level II dissection]]



Clavi-pectoral fascia



Clavi-pectoral fascia

- CALL: structures piercing the clavi-pectoral fascia[costo-coracoid ligament]

  Cephalic vein

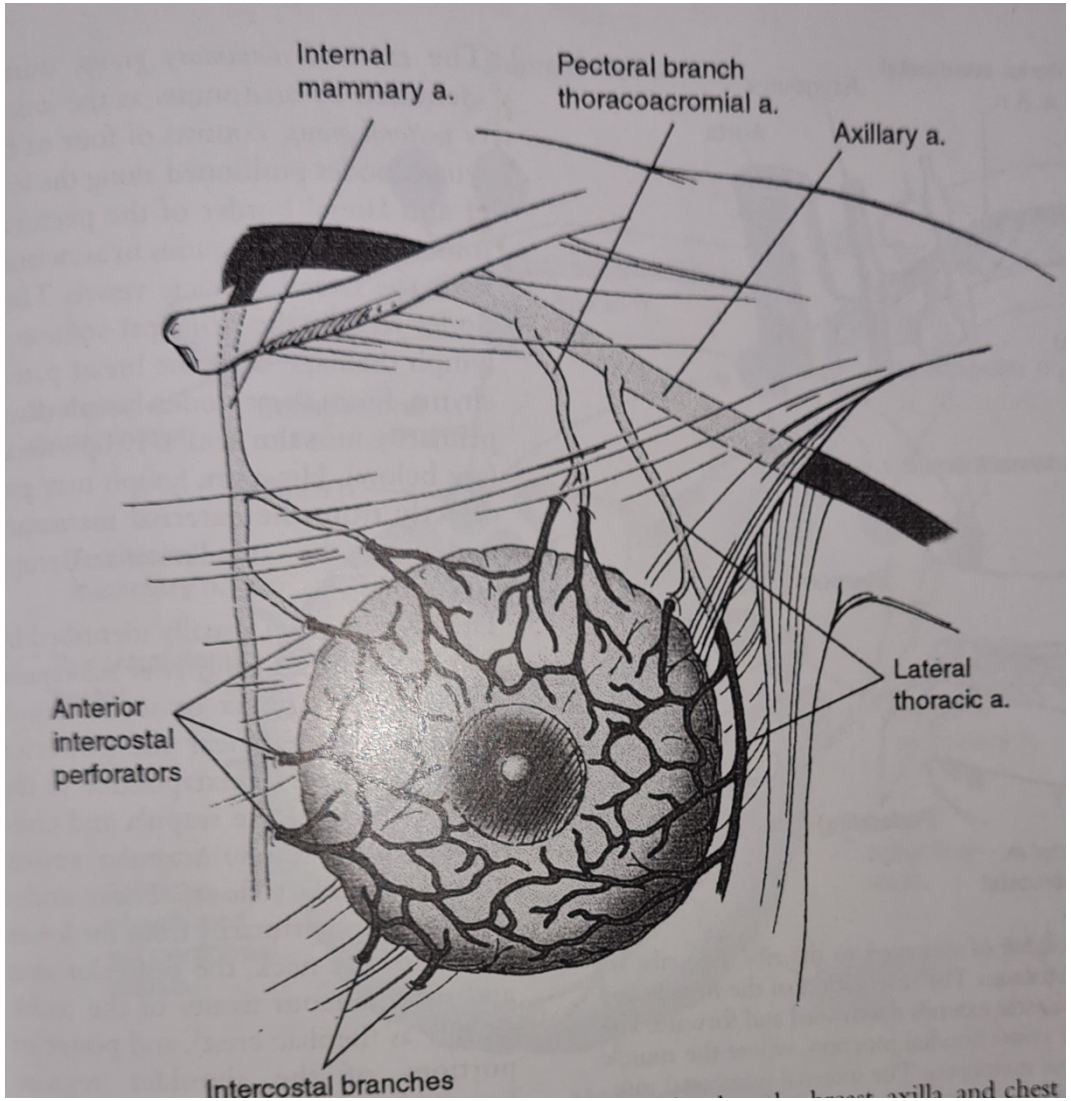
  Thoraco-acromial artery[A for artery]

  Lateral pectoral nerve

  Lymphatics

Blood supply of the breast

Perforators can bleed during removal of the breast from the pectoralis major muscle



Read on venous drainage.
NB: Batson's plexus of veins[metastases to ribs, long bones and pelvis.

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Lymphatic drainage of the breast

- Originates from the lobules, flow through intra-mammary [in the breast parenchyma] lymph nodes, channels into a sub-areolar plexus[Sappey's], and finally into the axilla, through 3 path-ways.

a. Axillary/lateral path-way

> about 75% of lymph from the breast

> drains the lateral quadrants either directly or via Sappey's plexus,
to the axilla

b. Internal mammary path-way

> about 25% of the drainage from the breast

> originates from both the medial and lateral quadrants[mostly medial]

> passes through the inter-costal space and pectoralis major to the para-sternal/ internal mammary lymph nodes

c. Retro-mammary path-way[deeper part of the breast]

> drains into the sub-clavicular plexus

- If usual path-ways are blocked, then drainage to:

> contra-lateral lymph nodes

> cervical lymph nodes

> peritoneal cavity

> liver

Above flows through the diaphragm or through the rectus sheath

Axillary lymph-nodes

- Six groups of nodes

  1. Anterior/ pectoral/external mammary[5-6]

     > medial/lower border of pectoralis minor muscle

     > associated with the lateral thoracic artery

     > drains major part of the breast and upper part of the trunk [anterior aspect]

  2. Posterior/sub-scapular[5-7]

     > at the lateral edge of the scapula, anterior to sub-scapular muscle

     > along the subscapular artery

     > receive lymph from the axillary tail of the breast and the upper halve of the trunk anteriorly

3.Lateral/axillary vein/humeral[4-6]

> along the lateral wall of the axilla, at the junction of the vein and latissimus dorsi muscle/tendon

> receives drainage from the upper limb

4. Central[4-5]

> below pectoralis minor muscle

> receives lymph from the above groups

5. Inter-pectoral/ Rotter's[1-4]

> between pectoralis muscles

6. Apical/infra-clavicular/ sub- clavicular/ delto-pectoral[8-12]

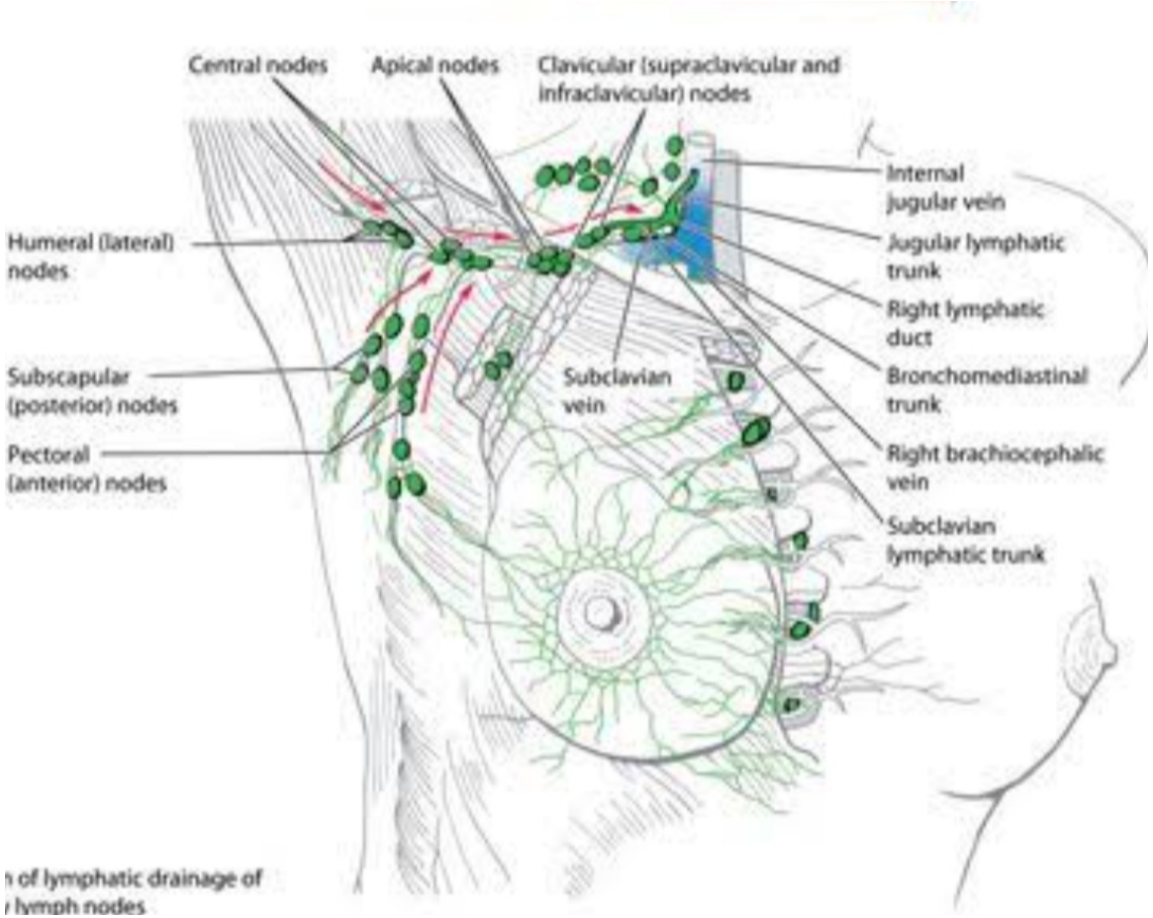
> in the apex of the axilla

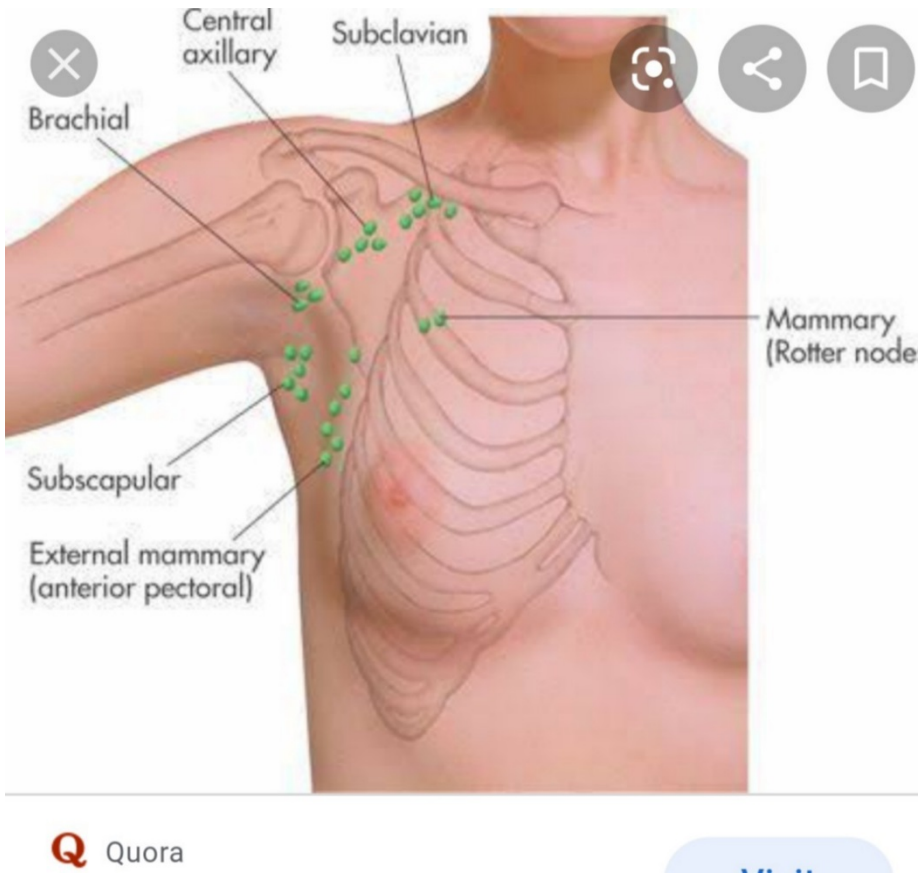
> drains the groups named above

>related to and drains through the subclavian trunk into the supraclavicular nodes

> supra-clavicular nodes drain into the thoracic duct[left] and into the right lymphatic trunk on the right.

Lymphatic drainage of the breast



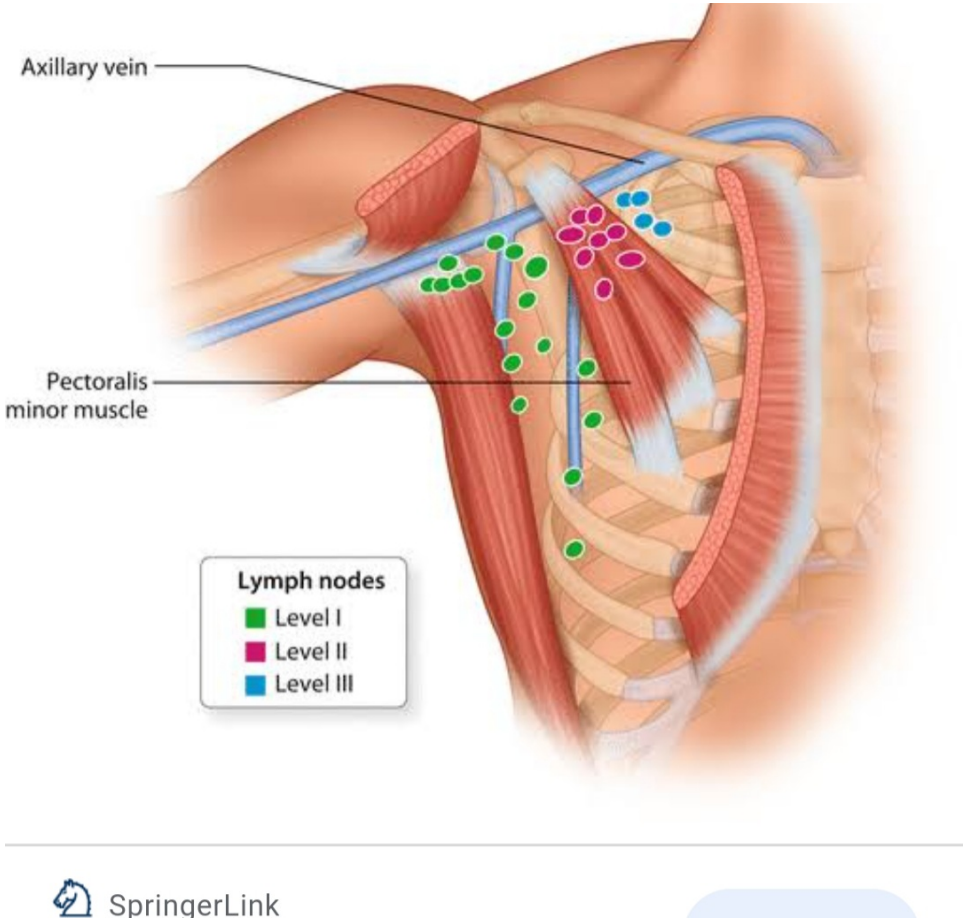


Surface area view of the lymph node groups

Levels of axillary lymph nodes

Level I lymph nodes Situated lateral/ inferior/below the inferior or lower border of pectoralis minor muscle[lateral, anterior and posterior groups]

Level II lymph nodes are anterior [superficial] or posterior[deep] to the pectoralis minor muscle[Rotter's and central]



Level III lymph nodes are medial/ above/ superior to the superior or upper border of pectoralis minor muscle[apical]

Mastectomy: types

1] Halsted's radical mastectomy: removal of the breast[Halsted and Meyer]
pectoralis major
pectoralis minor
levels 1, 11, and 111 axillary nodes

2] Modified radical mastectomy[MRM]: a. Patey's MRM[Patey and Dyson]
removal of pectoralis minor, all axillary lymph nodes, sparring pectoralis major muscle
Further modification> only detatch pectoralis minor from its insertion at the coracoid process

b. Scanlon's MRM > spares both muscles
Only retracts pectoralis minor muscle to remove level 3 lymph nodes

c.Auchincloss MRM> removes the breast
fascia of pectoralis major
level 1 and 11 lymph nodes

3. Simple or total mastectomy

4. Skin sparring mastectomy

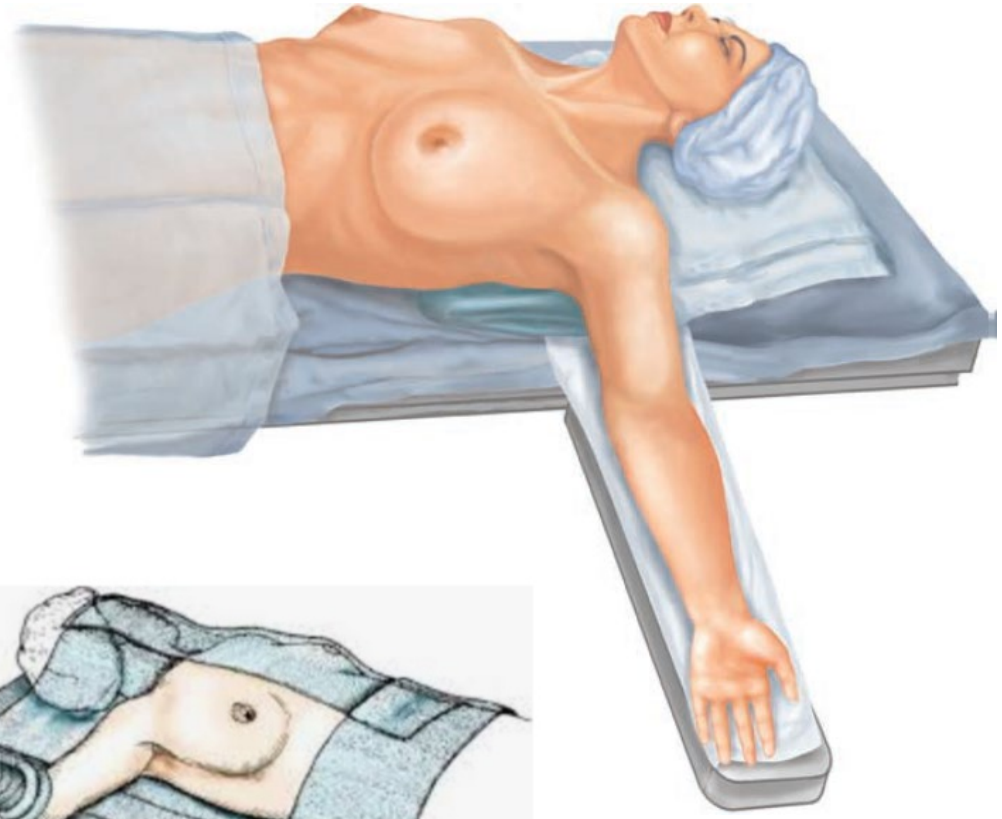
5. Nipple sparring or subcutaneous mastectomy

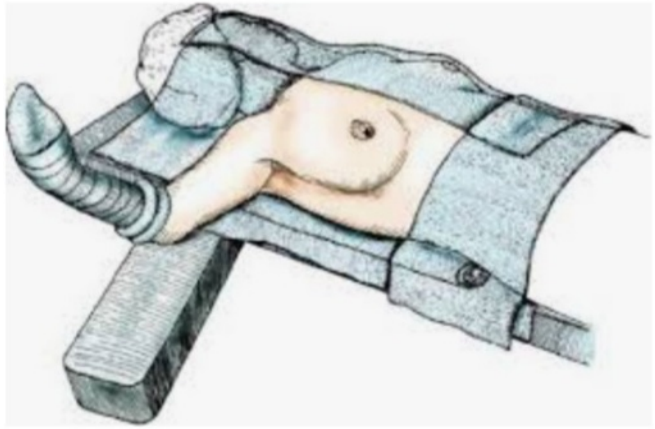
6.Toilet mastectomy: palliative, removal of a fungating, foul smelling, bleeding tumor to save life or improve quality of life

7.Extended radical mastectomy
As in radical + removal of internal mammary nodes

Nerves

- Intercostobrachial nerve: sensation to medial aspect of the arm[lateral cutaneous branches of 2^{nd} and 3^{rd} intercostal nerves]
- Long thoracic nerve: to serratus anterior [C5,C6 ,C7]
- Lateral pectoral nerve: to pectoralis major and minor[C5,C6,C7]
- Medial pectoral nerve : to pectoralis minor and major [C8,T1]
- Thoracodorsal nerve: to latissimus dorsi [C6,C7,C8]





Technique of Radical Mastect…

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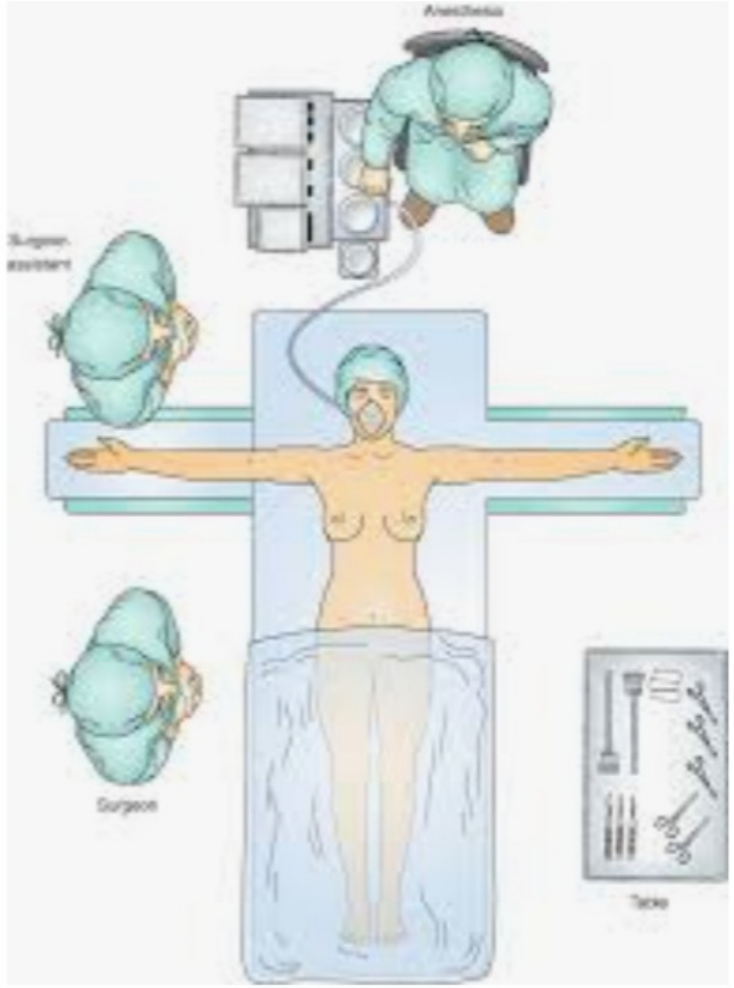
- Position
  - The patient is placed in supine position with the arm abducted ≤ 90 degree[avoid traction of the brachial plexus].
  - Sandbag or folded sheet is placed under the thorax and shoulder of affected side[movement of the arm and shoulder [easy access to axilla].
  - Patient positioned at edge of bed[easy access to breast and axilla, avoid undue traction to brachial plexus or pectoralis muscles]
  - Skin is prepared with antiseptic solution and draped
  - Arm is prepared and draped separately to allow reposition intra operative.
- Anaesthesia: General anaesthesia[without neuro-mascular blocking agent or only on induction, to avoid nerve injury during axillary dissection[identify when about to be injured]

  Thoracic paravertebral nerve blocks may be given



Modified Radical Mastectom…

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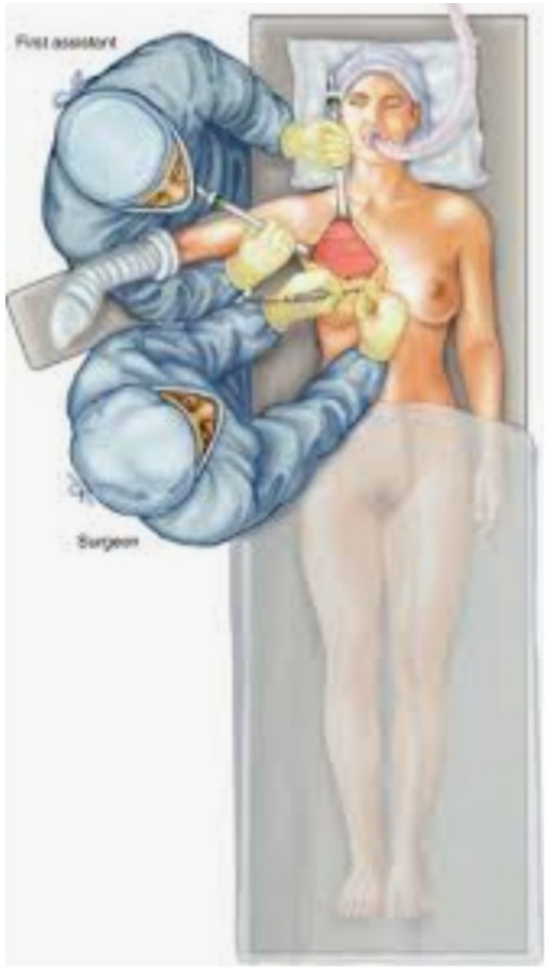

Modified Radical Mastectom…

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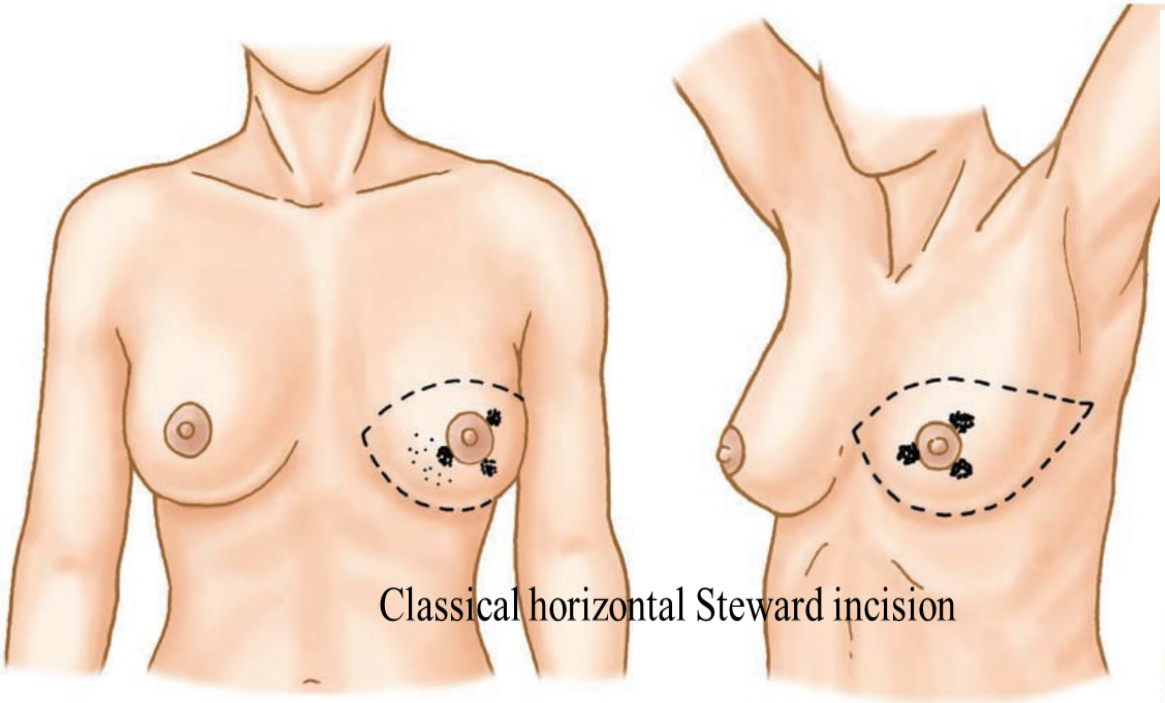
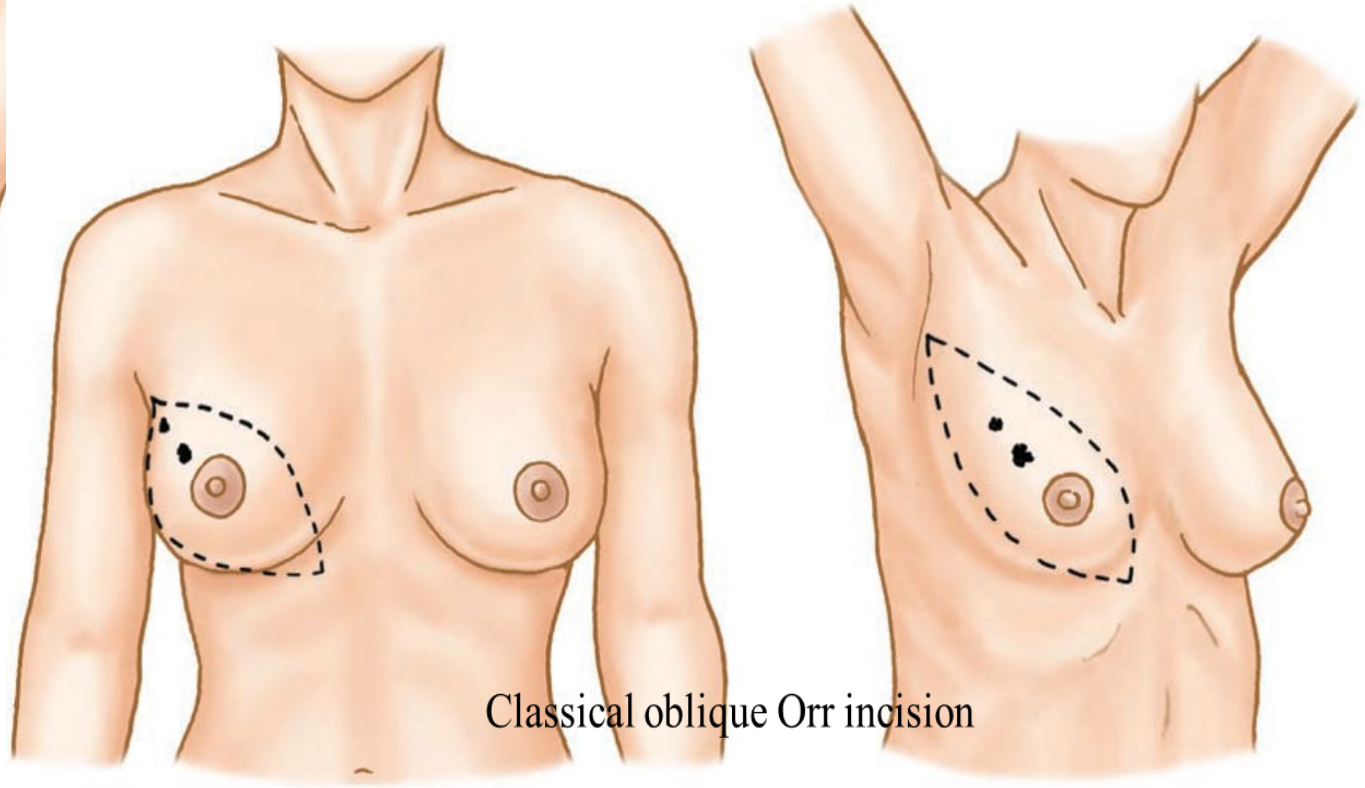
Second surgical assistant , even 1st assistant may stand on the opposite side

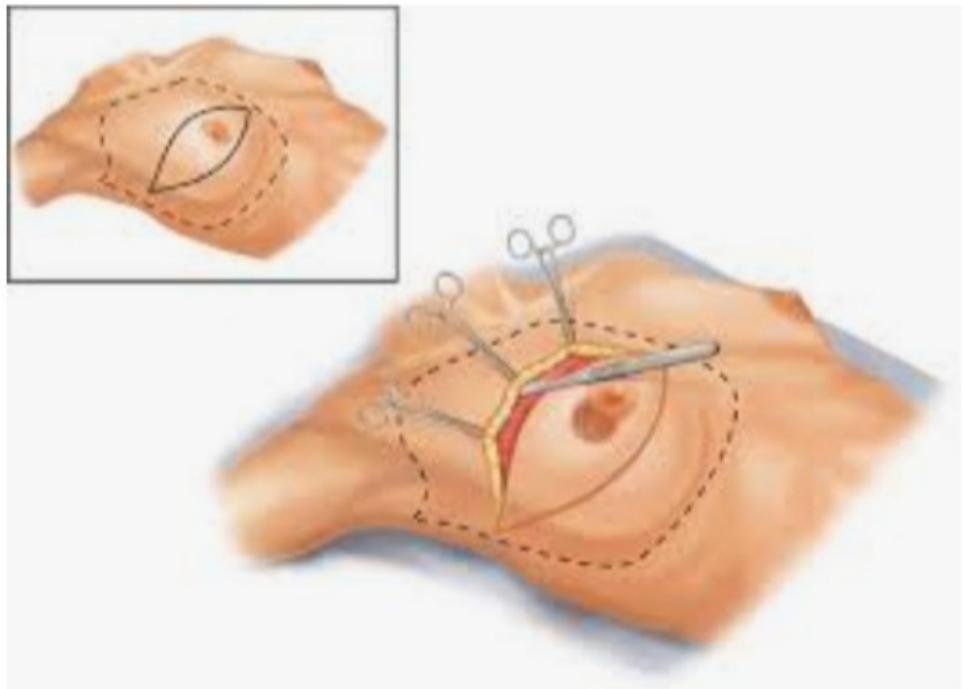
Incisions





Made with a knife through skin and dermis to allow the skin edges to separate

Use cautery or scalpel
Boundaries:
Laterally: anterior margin of latissimus dorsi
Medially: midline/middle of the sternum
Superiorly: subclavius muscle or the clavicle
Inferiorly: 2-3 cm below the inframammary fold



Modified Radical Mastectom…
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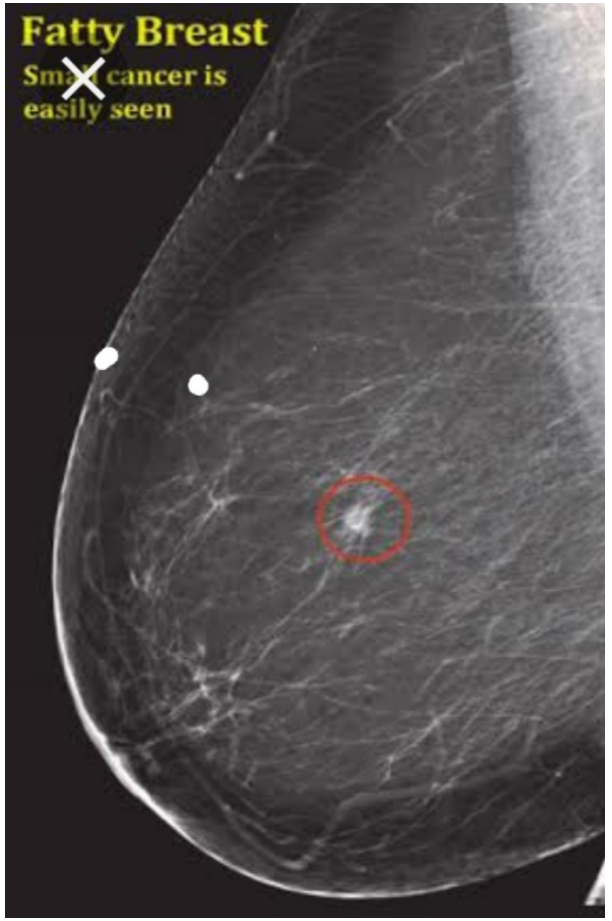
Skin flaps

- Plane identified by careful retraction skin with skin hooks/Allis forceps/ Lahey forceps[traumatic to tissue]

  and adequate counter traction by surgeon.
- This allows the surgeon to identify the avascular plane[superficial breast fascia between the breast and subcutaneous tissue.
- The flaps are raised to the borders mentioned in the previous slide.

Skin flaps

Vary in thickness depending on body Habitus
5mm-10mm[0.5-1 cm]
Fine/small fat globules
Appropriate dissection plain[avascular] deep to subcutaneous vasculature and Superficial to vessels of breast parenchyma

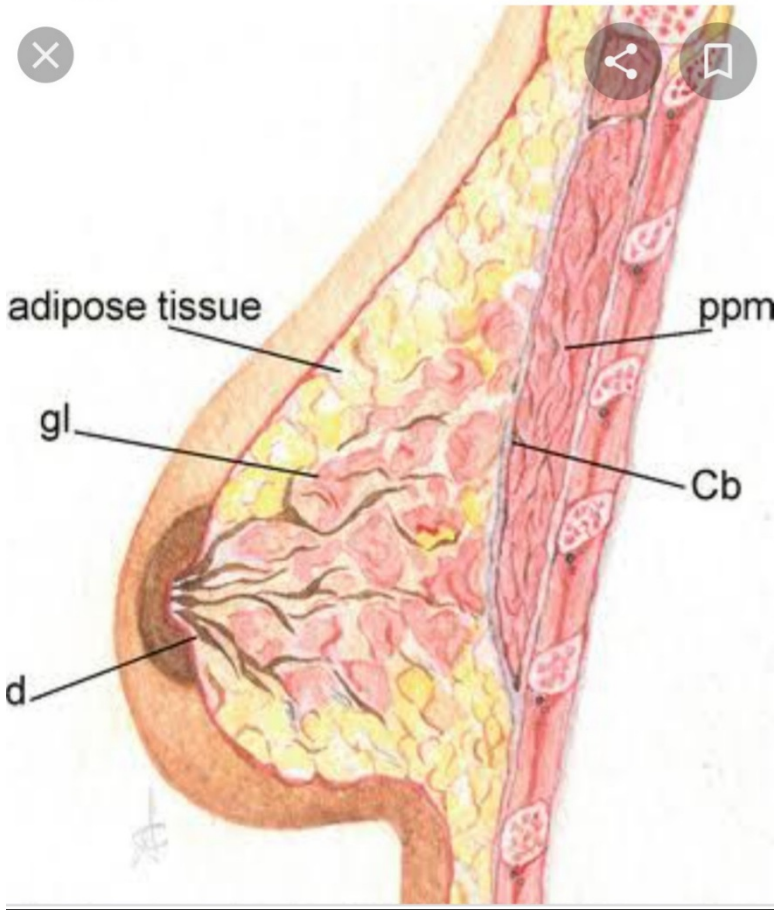


Flap thickness depicted by the 2 dots
Plane of dissection [deep dot]

Appropriate flap thickness:
Too thin> skin flap necrosis
Too thick> incomplete removal of breast tissue> may lead to recurrence

Appropriate plain of dissection> less Bleeding during flap elevation

Skin flaps



Plastic Surgery Key

Breast/ Radiology Key

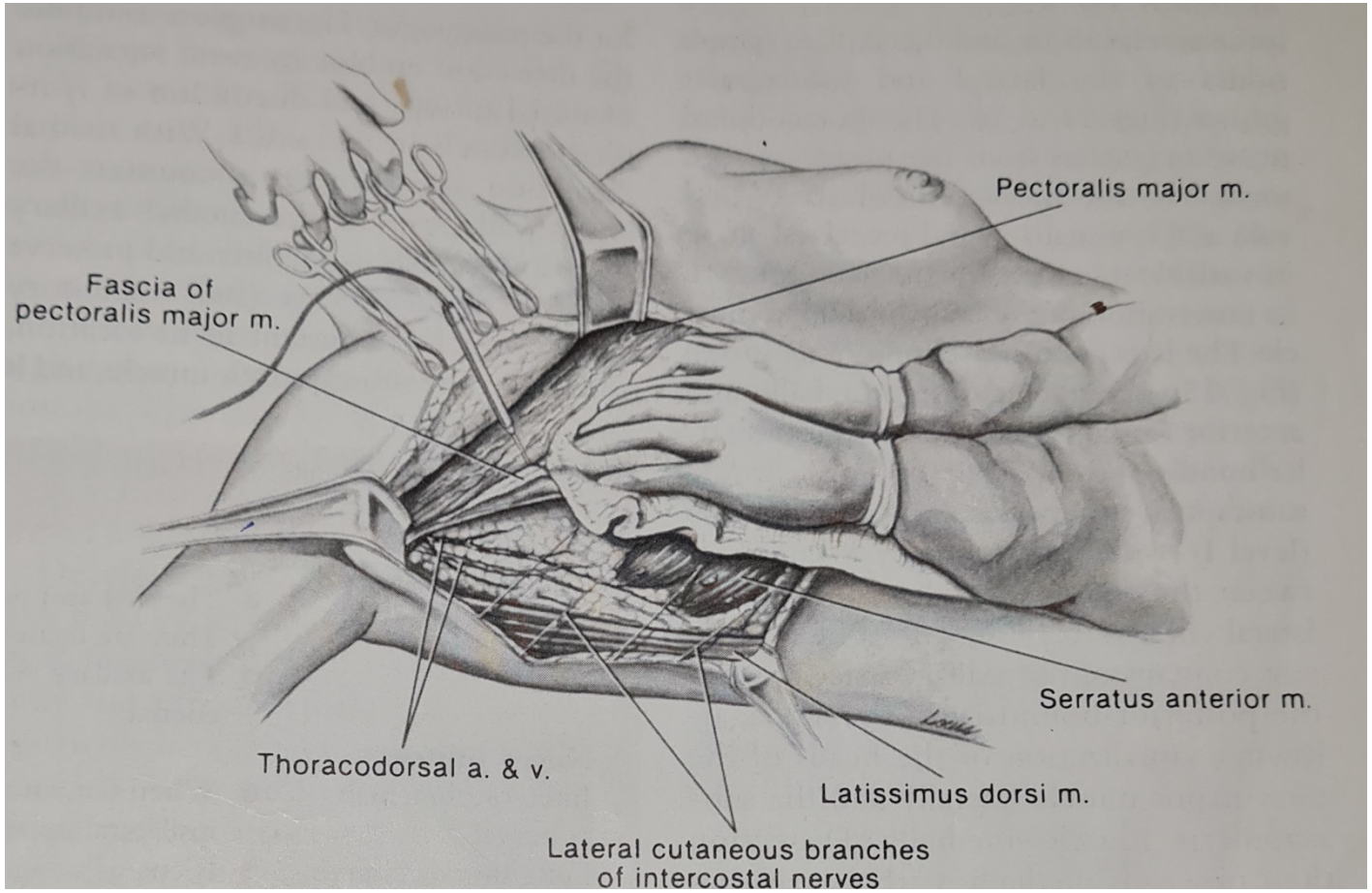
gl= glandular tissue
d= ducts[lactiferous]
ppm= pectoralis major muscle
Cb= Chassaignac's [retro mammary] bursa

The pectoralis major fascia is divided both superiorly and medially

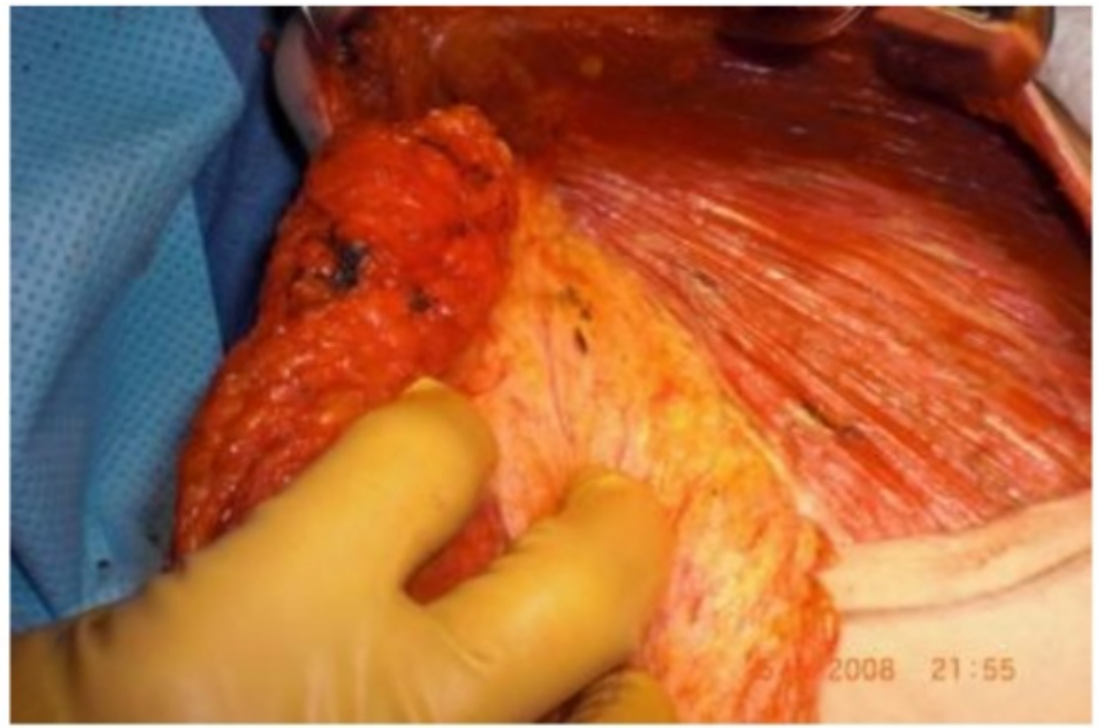
The breast parenchyma and pectoralis major fascia are removed from the chest wall.

The dissection proceeds to the Lateral edge of the pectoralis [superior-medially to inferior-lateral direction]

NB: Bleeding perforators, especially branches of internal mammary vessels [lateral border of sternum] These may be divided and suture ligated



Fischer J E, Bland K I et.al,Mastery of Surgery: 5th Edition

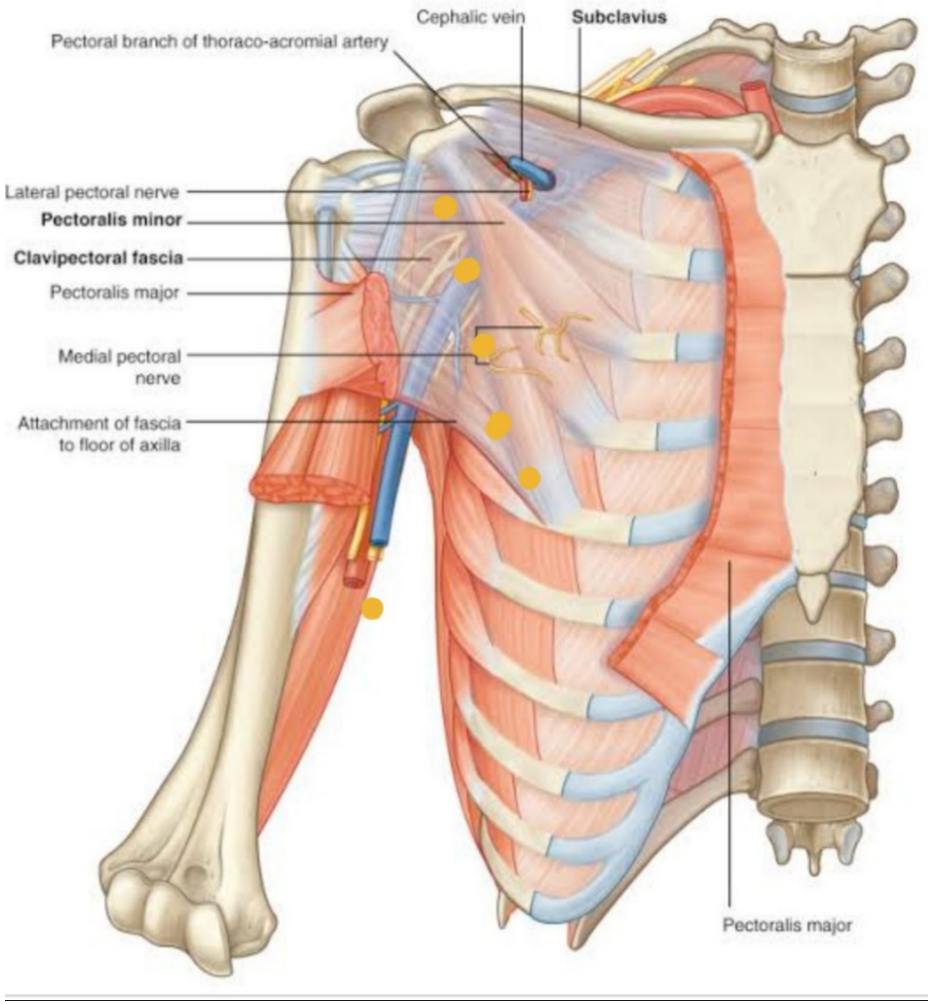


https:/emedicine.Medscape.com

Axillary lymph node dissection

The investing fascia of the axillary space[clavi-pectoral fascia] is sharply divided along the lateral border of pectoralis muscles[dotted yellow line], to enter the axilla

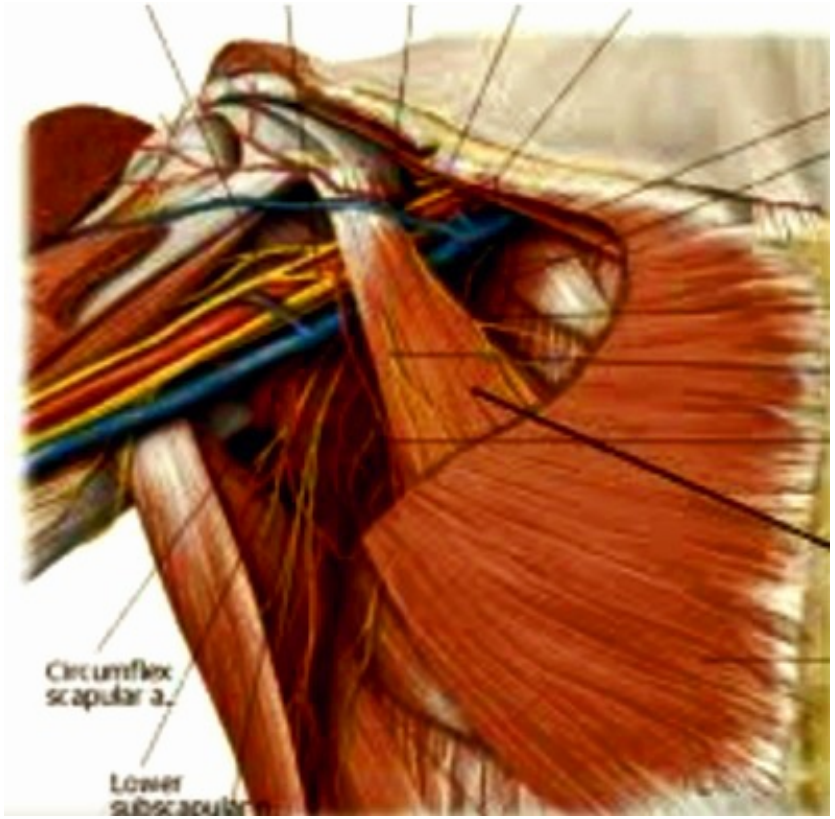
Fascia taut on palpation
Axillary fat ;soft and yellowish in color



NB: Be aware of the medial pectoral nerve
It normally pierces through the pectoralis minor to supply also the pectoralis major muscle[see diagram]

It may also run lateral to pectoralis muscle[with the lateral thoracic vessels] and can be injured when incising the fascia

Medial pectoral nerve sweeps either laterally around or through pectoralis minor muscle



Lateral pectoral nerve

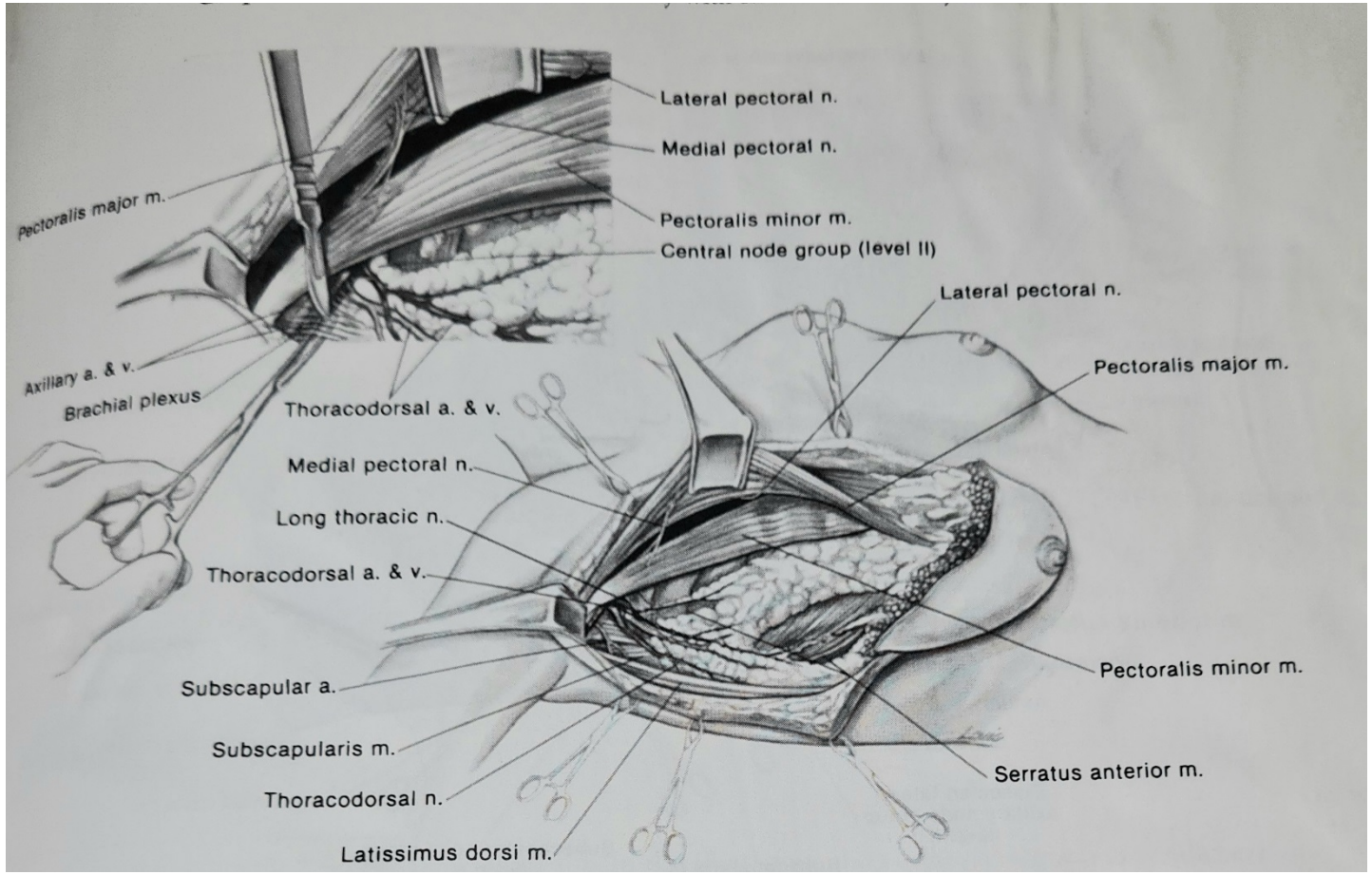
Medial pectoral nerve
Lateral thoracic artery

Pectoralis minor muscle

Pectoralis major muscle

After incising the investing axillary[clavi-pectoral] fascia, the pectoralis muscle is retracted to :

- expose the lateral and medial pectoral nerves neuro-vascular bundles and to
- Dissect/excise the inter-pectoral/Rotter nodes which are to be removed en block with the breast and the rest of axillary lymph nodes



Mastery of Surgery:5th Edition

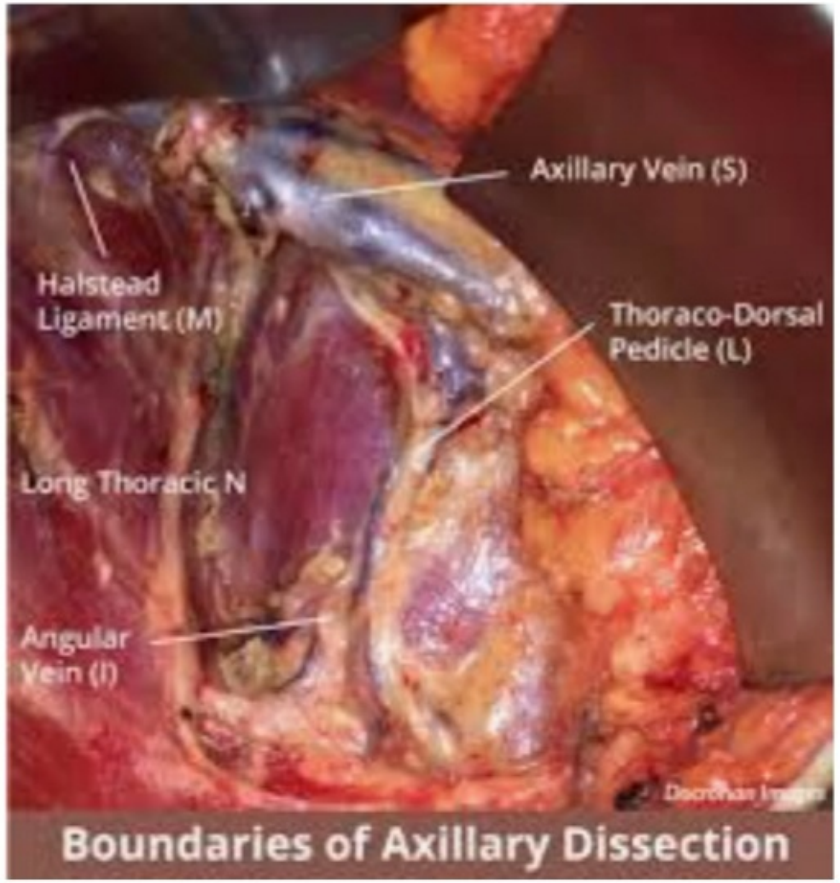
Borders/extent of axillary lymph node dissection

- Superior: axillary vein[remove tissue anterior aspect and inferior to vein]
  Dissection superior to vein> injury to brachial plexus
  > increased risk of lymphedema
- Lateral: anterior border of latissimus dorsi muscle/thoracodorsal pedicle
- Medial: lateral border of pectoralis muscle
  NB: retract pectoralis major> Rotter nodes
  retract pectoralis minor> central nodes
  both, level II nodes
- Inferior: 4^{th}or 5^{th} rib/angular vein[joins thoracodorsal to form subscapular vein]
- Posterior: Subscapular muscle

NB: Adequate lymph node dissection[minimum of 10 axillary lymph nodes]

The angular vein

NB: Just to illustrate the angular vein, tributary of thoracodorsal vein[considered as lower limit of axillary lymph node dissection]



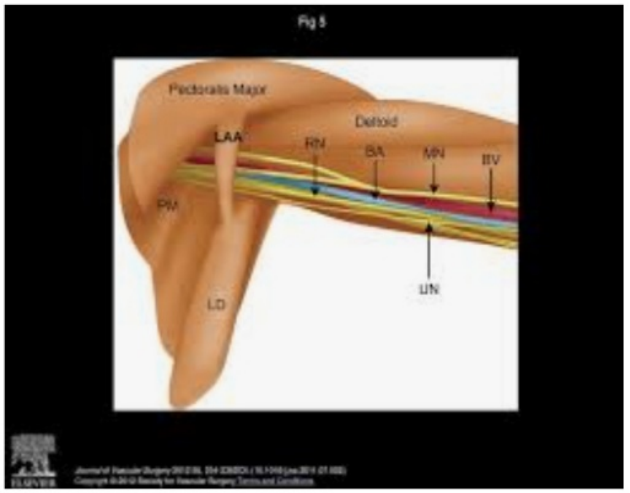
Axillary anatomy Flashcards |...
quizlet.com

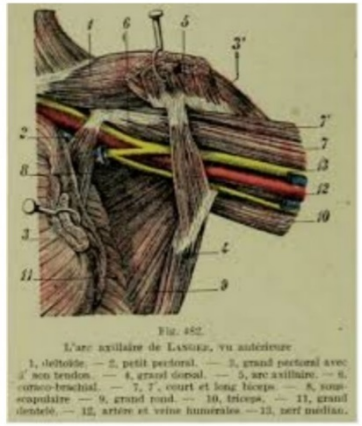
Lateral

1] How to identify the axillary vein

- Follow latissimus dorsi superiorly until it becomes tendinous or where latissimus tendon meet pectoralis major tendon
- Identify by retracting pectoralis minor muscle[easier]

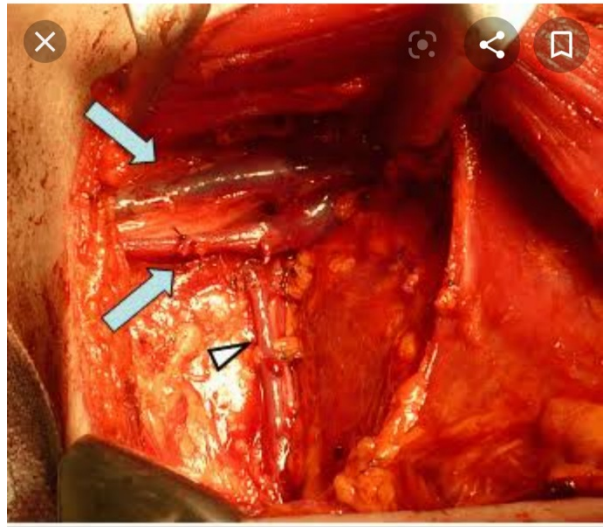
2] Anomalies of latissimus dorsi and axillary vein





Axillary arch of Langer from T...
researchgate.net

Langer's arch: rare anomaly
Muscle slips crossing axilla from LD muscle to posterior surface of pectoralis minor

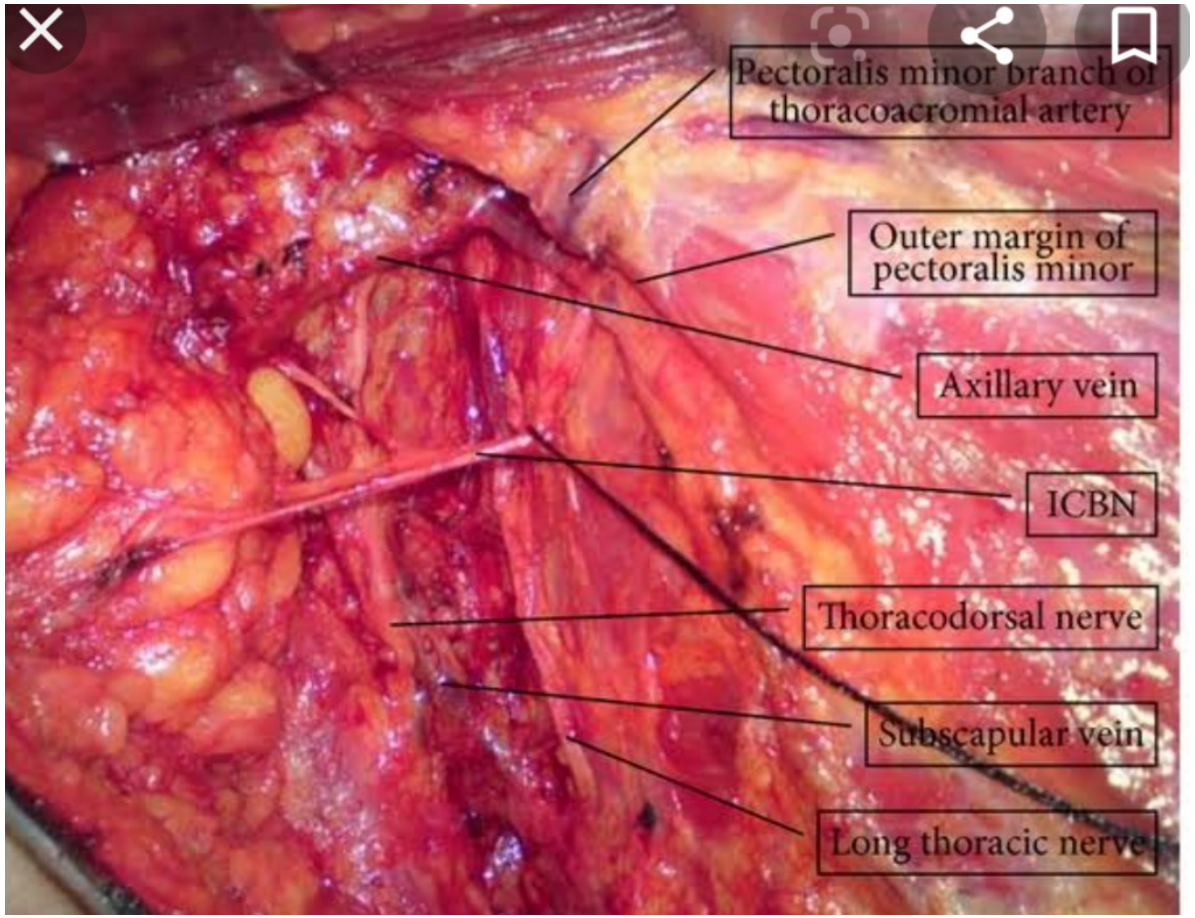


International Journal of Case Reports...

Double axillary vein

Structures to be preserved during modified radical mastectomy

Inter-costo- brachial nerve to be preserved if possible[sacrificed most of the time]



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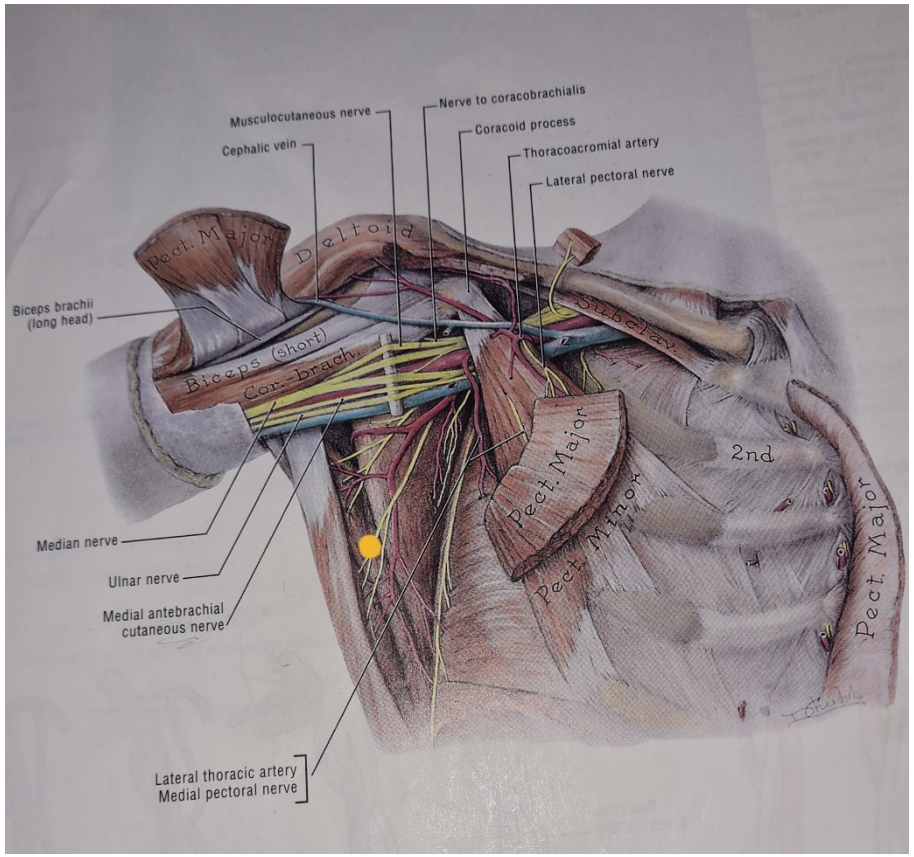


Fig 1

The thoracodorsal nerve is:

Initially medial to subscapular and thoracodorsal vessels. See fig 2

Lower/distally, lies in front, as it crosses the vessels and runs laterally to innervate the latissimus dorsi muscle

Researchgate.net

Fig 2

Axillary vein marked with 2 dots

NB: Thoracodorsal artery a branch/ continuation of subscapular artery

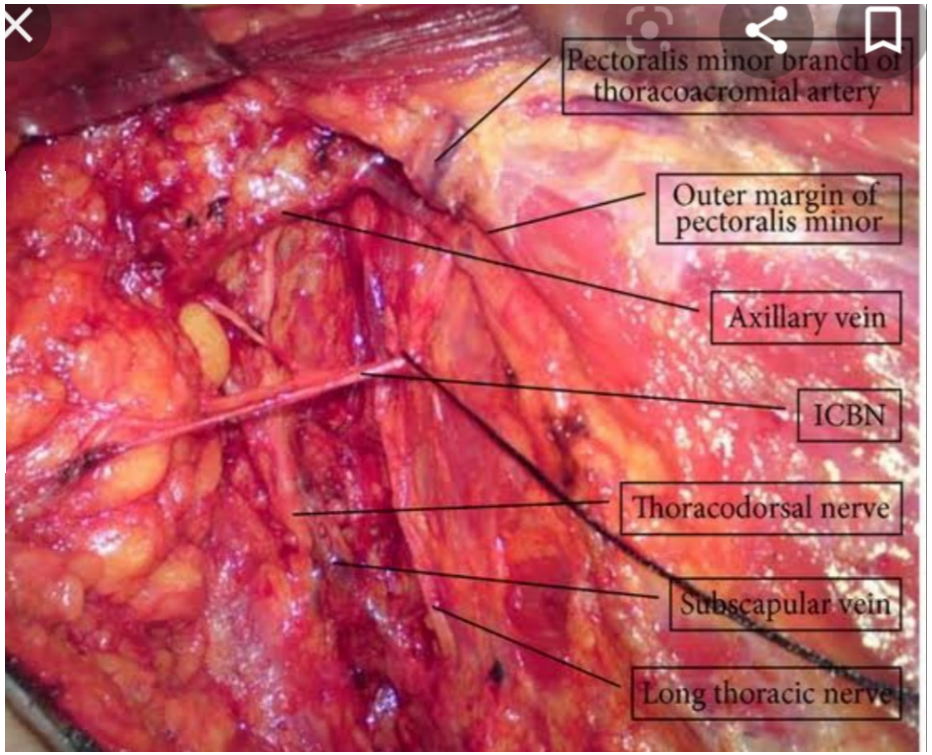
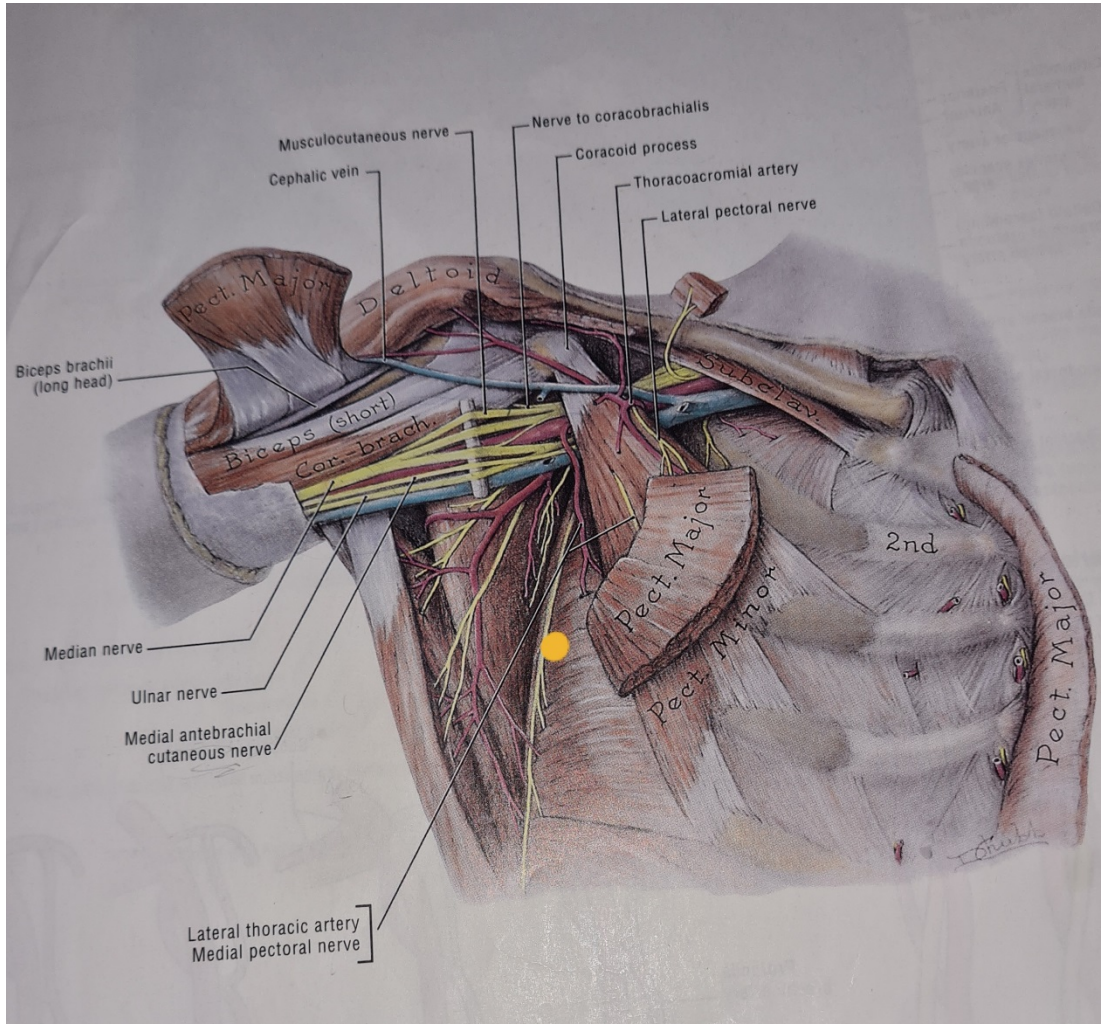
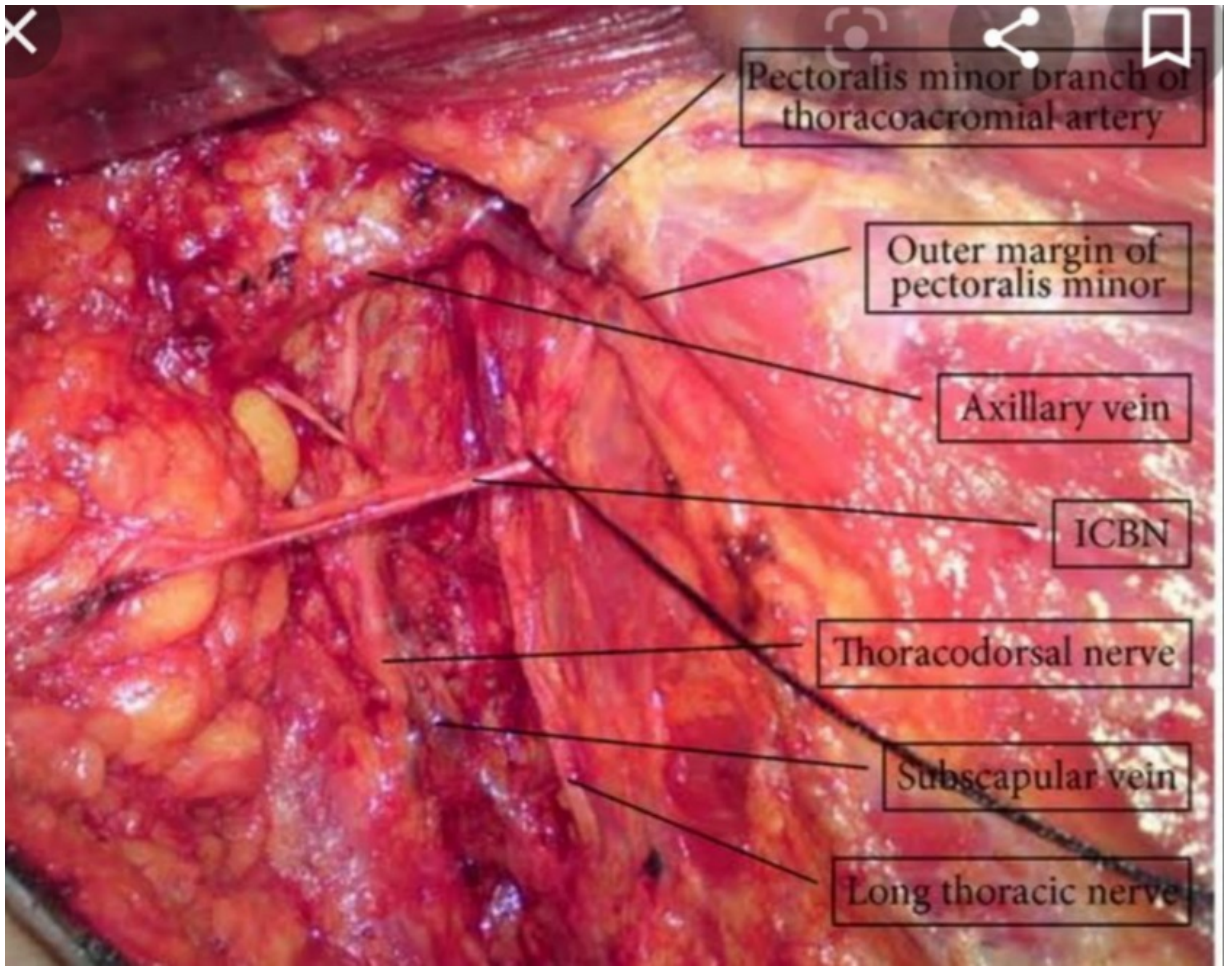


Fig 3

The thoracodorsal nerve may be identified posterior and lateral to the lateral thoracic vein. That is, 2 cm from the confluence of the lateral thoracic vein and the axillary vein. [NB: not illustrated in fig 3 above]





The long thoracic nerve runs just posterior to the midline, on serratus anterior muscle[yellow dot]

Complications

1.Neuro-vascular injury

TABLE 2. ANATOMIC COMPLICATIONS OF THE MODIFIED RADICAL MASTECTOMY

Vascular Injury	
	• The first and second perforating vessels are too large for cautery. They are ligated.
	• The axillary vein, if torn, is repaired. Ligation may cause chronic edema.
Nerve Injury	
Intercostobrachial nerve	• When cut, circumscribed numbness of the medial aspect of the ipsilateral upper arm results.
Long thoracic nerve	• If cut, a "winged scapula" deformity results.
Medial and lateral thoracic nerves	• If cut, the pectoralis muscles atrophy.
Thoracodorsal nerve	• If cut, internal rotation and abduction of the shoulder are weakened.

Mastery of Surgery 5th Edition

Brachial Plexus injury

Erb's Palsy

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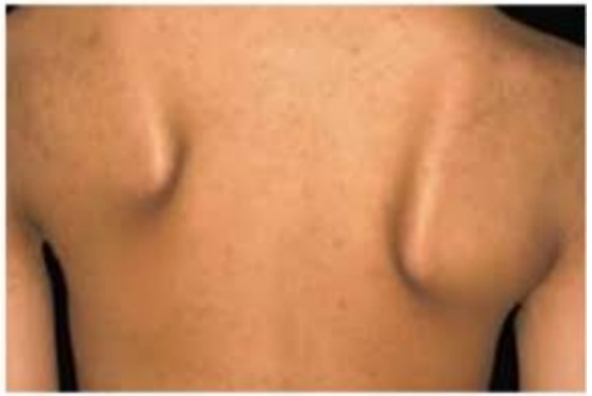

Winged Scapula

SlideShare

2. Hematoma[2%-10%]
3. Wound infection
4.Skin necrosis[often involves the superior flap and wound edges]
5. Wound dehiscence
6 Seroma[consequence of axillary lymph node dissection[ALND] or a complication?]
>? Electro-cautery higher rate versus scalpel
> Closure of dead space after axillary dissection] not consistently
> Use of fibrin sealants] effective
>Use of post operative compressive dressings[does not decrease seroma formation]

- Impact of axillary drains on seroma formation studied in randomized controlled trials[RCT]
  > Drain vs no drain
  > Active vs passive suction
  > High vs low pressure suction
  > Single vs multiple drains
  > Early vs late drain removal[we remove drains when out-put is < 30 ml in 24 hours]

Studies suggest that use of a single, closed, low pressure suction drain may lead to a decrease in seroma formation

- Early shoulder mobility post-operatively increase incidence of seroma formation

7. Decreased range of movement of shoulder joint and upper limb

8. Lymphedema

VI.? Role of reverse axillary mapping

VII. ? Role of endoscopic axillary surgery

Complications

a] Lymph-angio-sarcoma

Stewart-Treves syndrome

b] Cellulitis, skin necrosis gangrene

Treatment

Not discussed

TABLE 63-1 Lymphedema Risk-Reduction Practices

I. Skin care: avoid trauma/infection to reduce infection risk
- Keep extremity clean and dry
- Pay attention to nail care; do not cut cuticles
- If possible, avoid punctures such as injections or blood draws
- Wear gloves while doing activity that may cause skin injury (dishes, gardening, etc.)

II. Activity/lifestyle
- Gradually build up the duration and intensity of any activity or exercise
- Monitor the extremity before and after activity for any change in size, shape, texture, soreness, heaviness, or firmness
- Maintain optimal weight

III. Avoid limb constriction
- If possible, avoid having blood pressure taken in at-risk limb

IV. Compression garments
- Support the at-risk limb during strenuous activity
- Consider wearing a well-fitting compression garment for air travel

V. Extremes of temperature
- Avoid exposure to extreme cold
- Avoid prolonged exposure to heat (particularly hot tubs or saunas)

Kuerer's Breast Surgical Oncology

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