Considerations When Treating the Shoulder in Patients with Breast Cancer

Diana Garrett, PT, DPT, OCS, FAAOMPT, CLT, CSCS

- UC Davis 2002-2006
  - Major: Exercise Biology Minor: Human Development
  - Student Athletic Training Program: Football, Track & Field, Women's Gymnastics
- USC 2006-2009
  - Doctor of Physical Therapy Degree
- Certified Strength and Conditioning Specialist (CSCS) 2008
- Board-Certified Orthopedic Clinical Specialist 2013
- Certified Lymphedema Therapist (CLT) 2015
- Certification in Orthopedic Manipulative Therapy (COMT) 2022
- Fellowship in Orthopedic Manual Therapy NAIOMT 2023

Program Director of Physical Therapy Services at Women's Health and Wellness Institute at Providence Saint John's Health Center

Oncology Rehabilitation

Orthopedics/Post-Operative

Pregnancy/Post-Partum

Physical Therapist with Los Angeles Dance Project

Breast Cancer Statistics

- Breast cancer accounts for about 30% of all new cancer cases in the US in women
- Estimated that there will be 316,950 new cases of invasive breast cancer in 2025
- The overall average risk of a woman in the US developing breast cancer is 1 in 8
  - Incidence rates have increased more in women younger than 50

National Breast Cancer Foundation 2025

Shoulder Dysfunction and Breast Cancer

- Various studies have shown an incidence up to 30-80% of shoulder/arm pain, restricted range of motion, and/or sensory changes in breast cancer survivors
  - One study showed 91% of women reported mild to severe arm/shoulder symptoms at 42 months post operatively

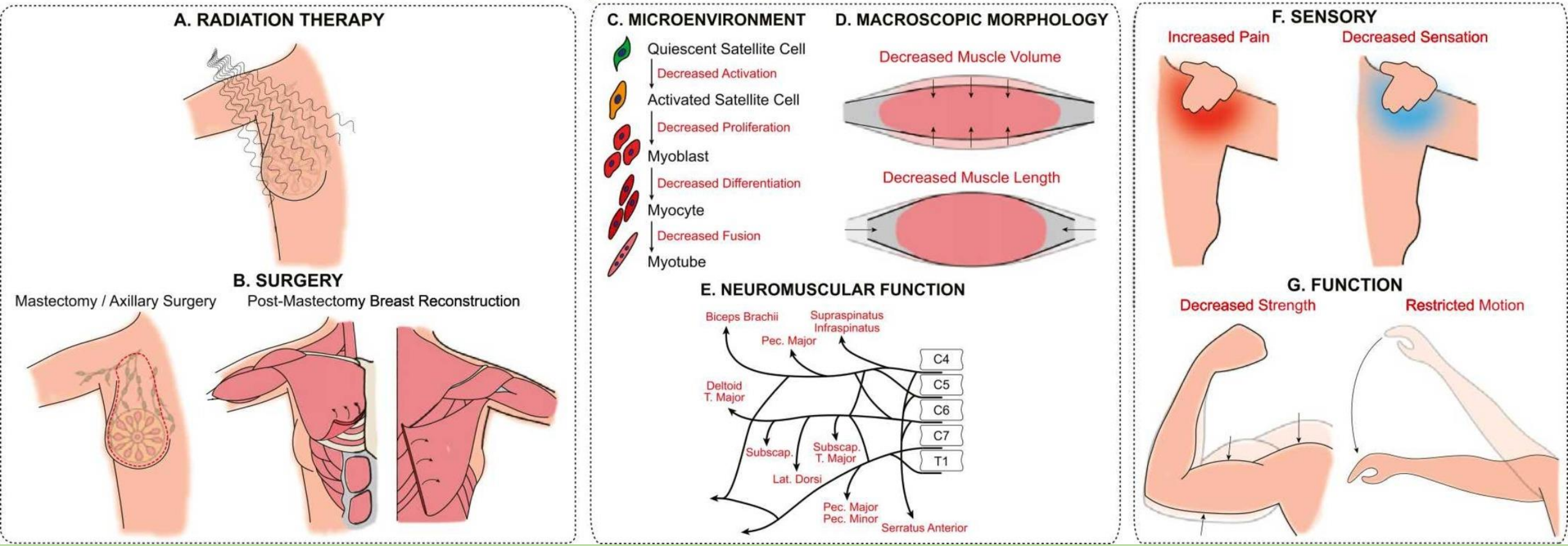
- Shoulder dysfunction in breast cancer patients can progress for 10 years after completing treatment secondary to late morbidity from chemotherapy and/or radiotherapy due to decreased cell proliferation

- Altered activity of shoulder girdle muscles impair the stability and fine movement of scapula post breast cancer treatment, and may require greater muscle recruitment to overcome the loss of tissue extensibility

Co-morbidities and epidemiology

- Common complaints of shoulder/arm pain, restricted motion, weakness, sensory changes, and/or edema
  - Secondary to neuromusculoskeletal tissue changes, scar tissue formation, postsurgical pain, and/or protective posturing
- 90% of shoulder dysfunctions develop during the first 3.9 years after cancer treatment
- Pain becomes chronic and persistent in 60% of cases reported by breast cancer survivors
- Risk factors for development of shoulder dysfunction: older age, higher BMI, preoperative breast pain, type of surgery, ALND, chemotherapy, radiation

The Impact of Local Therapies for Breast Cancer on Shoulder Muscle Health and Function



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Patient Case: JB

- 65 year old female with primary complaint of left shoulder pain and limited mobility
  - Difficulty reaching overhead, washing her back, carrying groceries, UE weightbearing
- Breast Cancer History
  - 16 years ago – L Invasive Ductile Carcinoma (IDC)
    - Treated with lumpectomy, chemotherapy, radiation
  - 7 years ago – R Ductile Carcinoma In Situ (DCIS)
    - Treated with lumpectomy, radiation
  - 1 year ago – L IDC and R DCIS recurrence
    - Treated with chemotherapy, bilateral mastectomy with reconstruction, radiation

Chemotherapy

- Systemic treatment that effects all cells in the body
- Has a greater effect on rapidly dividing cells
  - The faster the cells divide the bigger the effect
- Each chemotherapy drug has a different effect
  - Anti-tumor Antibiotics – alter DNA inside cancer cells
  - Anti-angiogenesis – target blood vessels and blood supply to a tumor
  - Antimetabolites – substitute for the normal building blocks of DNA and RNA
  - Alkylating Agents/Platinum Drugs – directly damage DNA
  - Taxanes – impair dividing of cells, target microtubuli and mitochondria

Pharmaceuticals Used to Treat Breast Cancer

Anastrozole
Verzenio
Kisqali
Enhertu
Abraxane
Xeloda
Doxorubicin
Capecitabine
Fluorouracil
Piqray
Halaven
Kadcyla
Pertuzumab

Tamoxifen
Abemaciclib
Pemvrolizumab
Femara
Methotrexate
Afinitor
Ibrance
Trastauzumab
Fulvestrant
Tykerb
Infugem
Lynparza
Toremifene

Letrozole
Exemestane
Ribociclib
Aromasin
Taxotere
Cyclophosphamide
Paclitaxel
Docetaxel
Gemzar
Eribulin
Ixabepilone
Menest
Capivasertib

Arimidex
Keytruda
Trodelvy
Herceptin
Trexall
Faslodex
Perjeta
Everolimus
Palbociclib
Gemcitabine
Ixempra
Ogivri
Phesgo

Common Chemotherapy Drugs for Breast Cancer

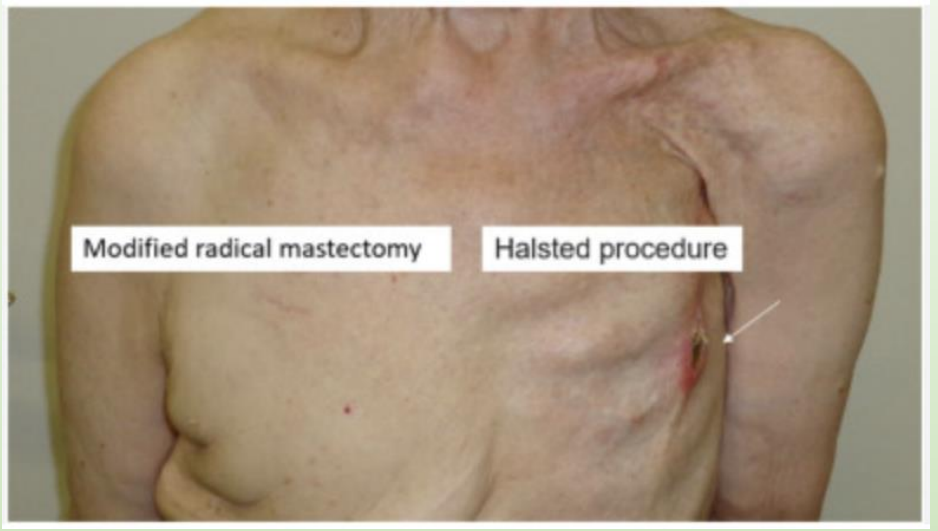
- **<u>Anthracyclines</u>:** *Damage DNA in cancer cells*
  - Doxorubicin (**Adriamycin**) - "The Red Devil"
    - Can lead to changes in heart function and decreased bone marrow blood cells
- **<u>Taxanes</u>:** *Interferes with cell division*
  - Paclitaxel (**Taxol**)
    - Can lead to hair loss, bone marrow suppression
  - Docetaxel (**Taxotere**)
    - Immune suppression
- **<u>Fluoropyrimidines</u>:** *Anti-metabolites*
  - 5-fluorouracil (**5-FU**)
    - Skin changes
  - Capecitabine (**Xeloda**)
    - Peripheral neuropathy
- **<u>Platinum Drugs:</u>** *Impairs cellular repair*
  - Carboplatin **(Paraplatin)**
    - Nerve damage, Increase risk for blood clots
- **<u>Alkylating Agents:</u>** *inhibit DNA transcription*
  - Cyclophosphamide **(Cytoxan)**
    - Also used in autoimmune disorders

Surgery

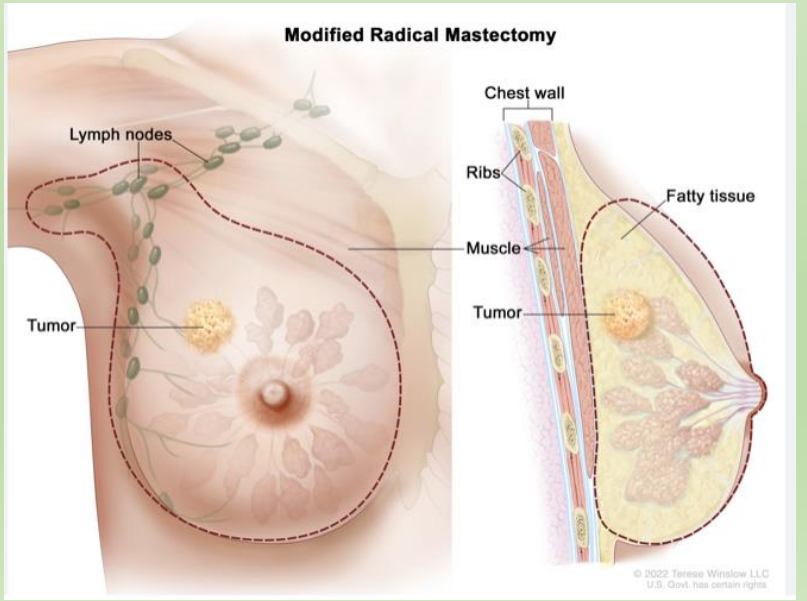
- Partial Mastectomy/Lumpectomy
- Modified Radical Mastectomy
- Reconstruction
- Sentinel Lymph Node Biopsy
- Axillary Lymph Node Dissection

Mastectomy

- Radical Mastectomy (Halstead Procedure)
  - The entire breast is removed, including the nipple, the areola, the overlying skin, the lymph nodes under the arm, and the pectoralis muscle
    - Phased out late 1970's/1980's
- Simple Mastectomy
  - The removal of the entire breast, including the nipple, areola, and overlying skin
  - Leaves the chest wall, including pectoralis muscles intact
- Modified Radical Mastectomy
  - Removes above, along with the lymph nodes under the arm (axillary lymph nodes)
  - Leaves the chest wall, including pectoralis muscles intact

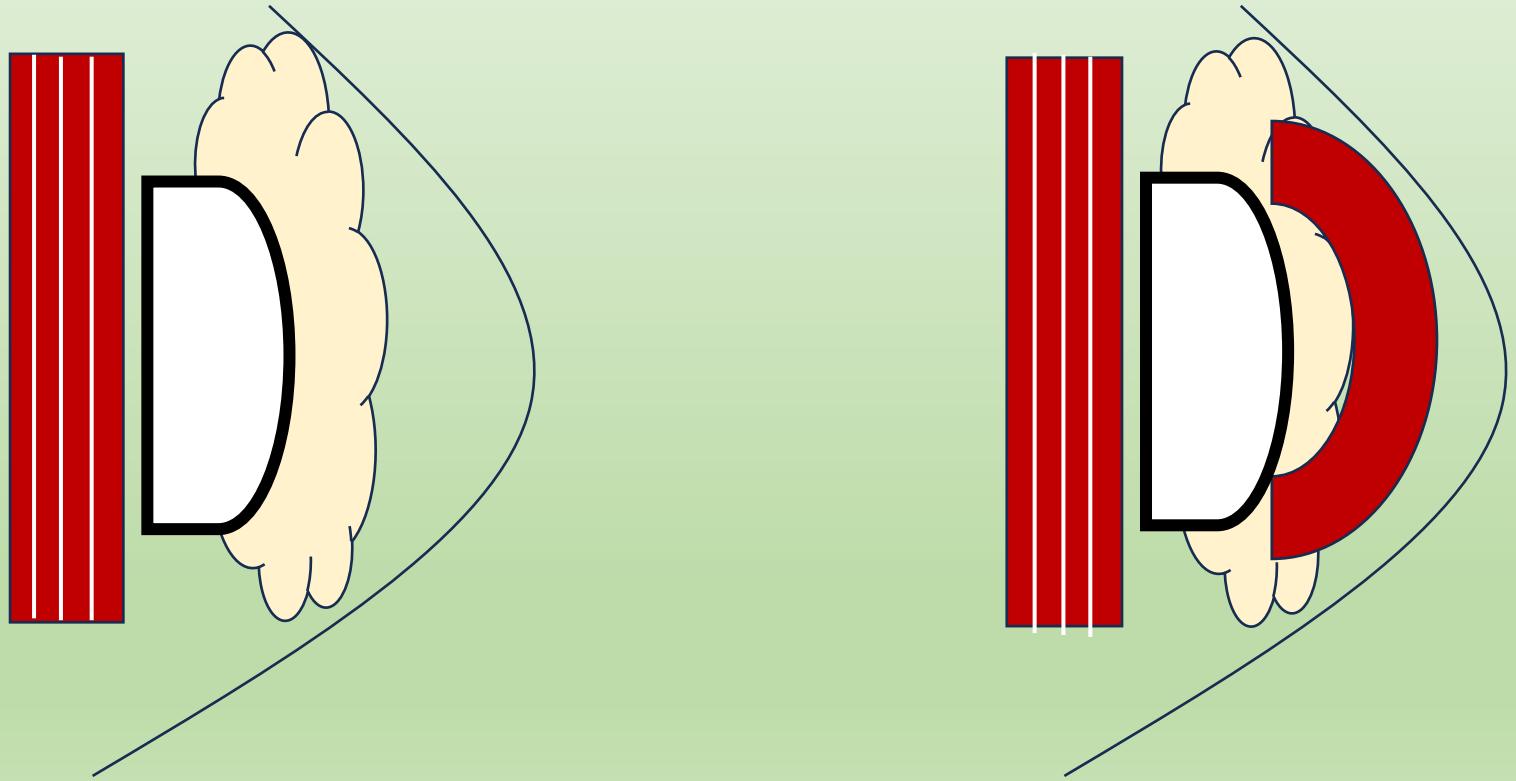


https://www.sciencedirect.com/topics/medicine-and-dentistry/modified-radical-mastectomy



Cancer.gov

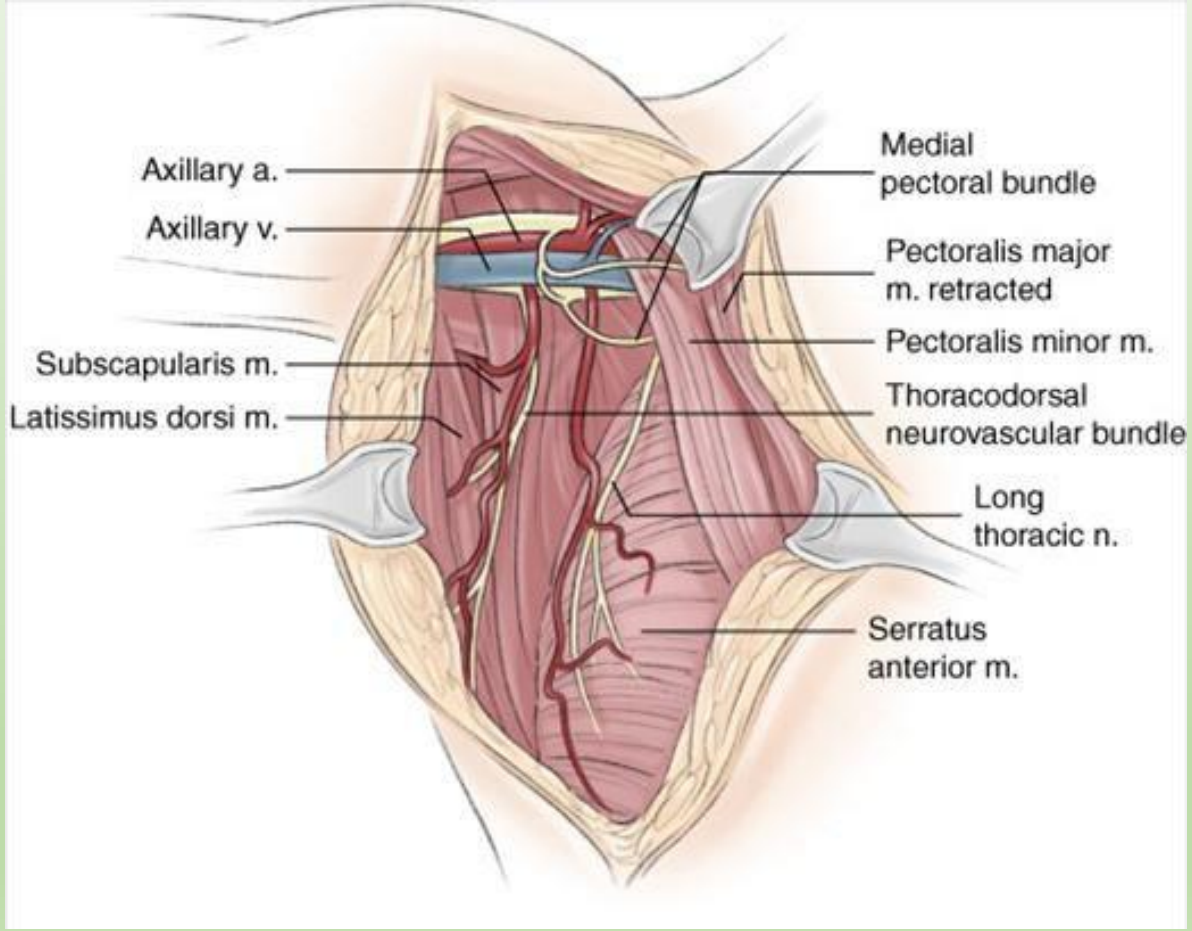
Mastectomy with sub-pectoral implant reconstruction



JB's Surgery

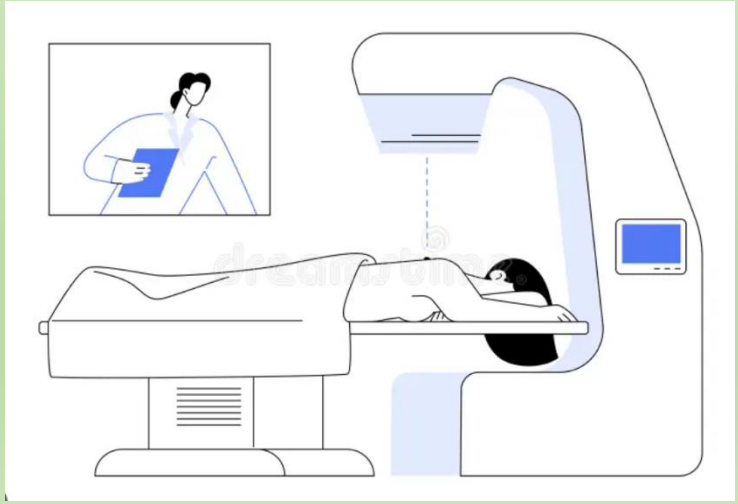
- Mastectomy with Reconstruction and Axillary Dissection

- "…firm mass was high enough to be near her brachial plexus since pressure on adjacent structures caused arm movement."



Radiation Therapy

- High-energy particles that damage/destroy cancer cells
  - Can be through external beams or internal implant
- Radiation damages the DNA within cancer cells either by direct effect or through creating free-radicals that can damage the DNA
  - Studies have shown that radiation may stimulate a cytokine/ inflammatory reaction
- Side Effects include:
  - Skin changes
  - Fatigue
  - Radiation fibrosis



Breast Radiation
Therapy Techniques

Radiation Fibrosis

- Excessive inflammation leads to proliferation of fibroblasts and excessive deposition of collagen
  - Results in scar-like fibrous tissue
  - May cause fibrosis of the capsule and chest-wall that is dependent on dose and location
    - The pectoralis major may become fibrotic with radiotherapy involving the infraclavicular nodes
- Inflammatory responses from radiation influence the vascularity and collagen deposition in the targeted region
  - There is potential for fibrosis of the tendon and muscle sheath after radiation
- Doses of 15 Gy or higher correlated to greater shoulder morbidity
  - Conventional doses of radiation to the whole breast range from 45-50 Gy, and may be followed by boost treatment to localized breast tissue for an additional 10-16Gy

Evolution of Skin During Radiation Case

Her2andyou.com

Posture Analysis

Depression of L shoulder girdle

R lateral shear of thorax

Increased thoracic kyphosis

Atrophy L shoulder girdle

Winging Scapula

- Dysfunction of the muscles that stabilize the scapula
- Often involves weakness of the serratus anterior, trapezius, and/or rhomboids

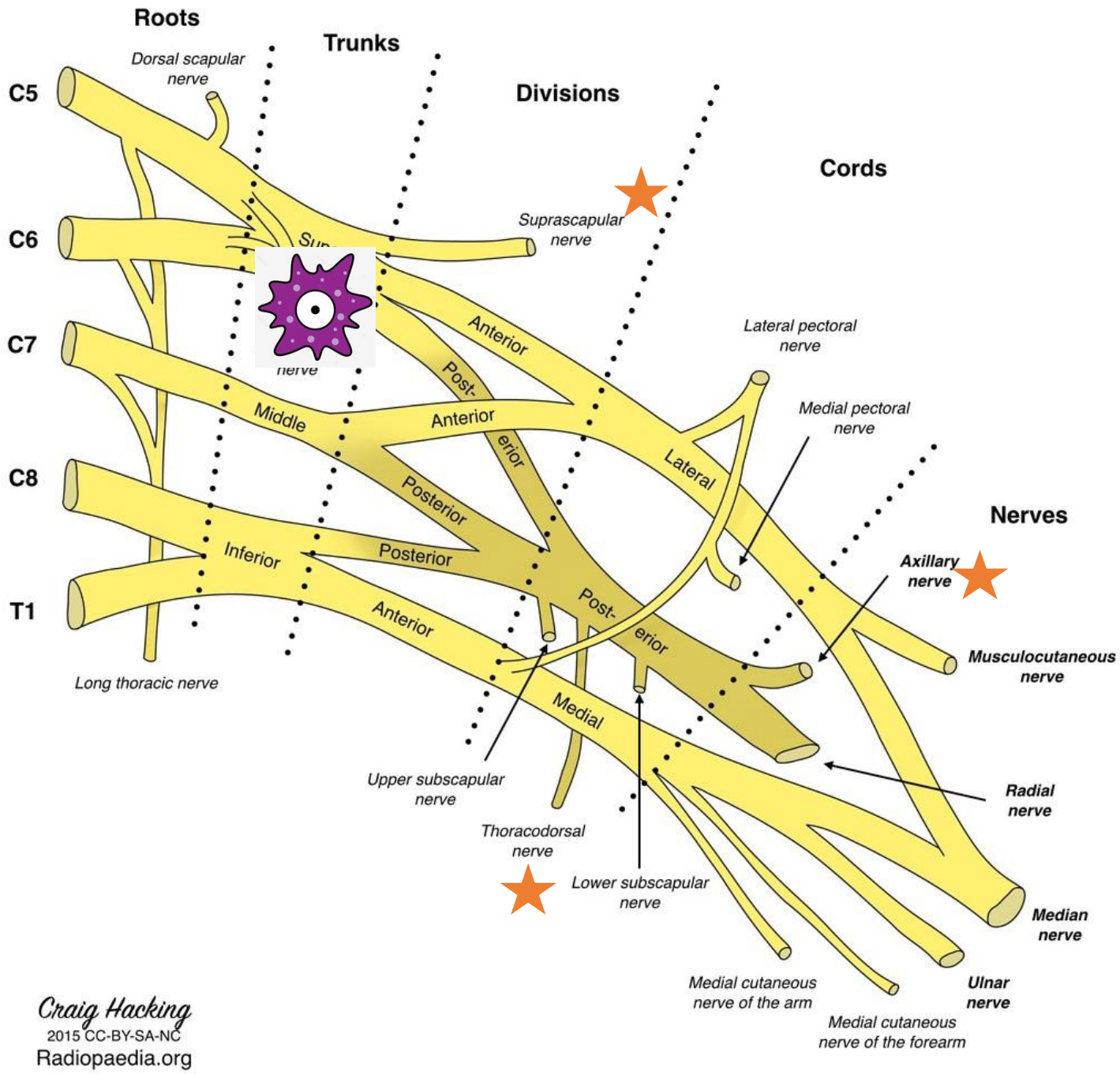
Initial Evaluation

	Right	Left	
	Active ROM	Active ROM	Passive ROM
Shoulder Flexion	170	105	170
Shoulder Abduction	175	115	170
External Rotation	75	40	80
Internal Rotation	HBB T7	HBB T7	70

Significant weakness of left shoulder flexors, abductors, external rotators
Some weakness of the shoulder extensors

What Nerve is it?

- Latissimus Dorsi – Thoracodorsal Nerve
- Supraspinatus – Suprascapular Nerve
- Teres Minor – Axillary Nerve
- Deltoids – Axillary Nerve
- Serratus Anterior – Long Thoracic Nerve


Roots
Trunks
Divisions
Cords
Nerves
C5
C6
C7
C8
T1
Dorsal scapular nerve
Suprascapular nerve
Long thoracic nerve
Upper subscapular nerve
Thoracodorsal nerve
Lower subscapular nerve
Lateral pectoral nerve
Medial pectoral nerve
Axillary nerve
Musculocutaneous nerve
Radial nerve
Median nerve
Ulnar nerve
Medial cutaneous nerve of the arm
Medial cutaneous nerve of the forearm
Anterior
Middle
Posterior
Inferior
Lateral
Medial
Post-erior
Craig Hacking
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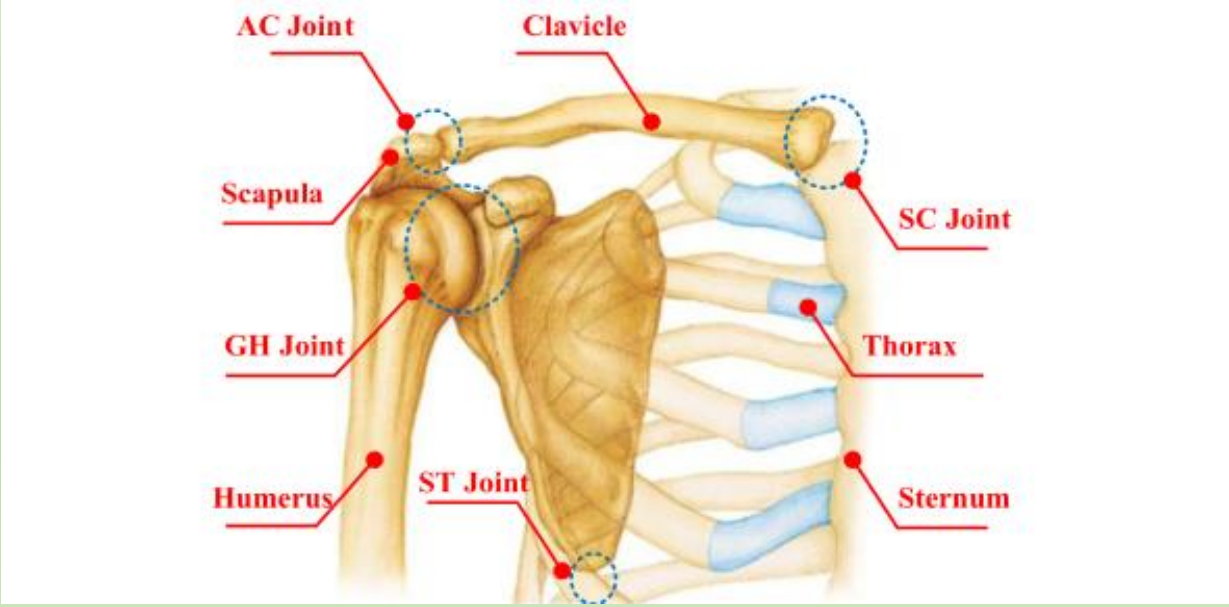
Treatment

- Soft Tissue Mobilization
  - Pectoralis major, pectoralis minor, biceps, upper traps, levator scap
- Fascial Mobilization
  - Pectoral, infraclavicular, axillary
- Joint Mobilization
  - Improve thoracic spine mobility, scapular mobilizations
- Neuromuscular Electrical Stimulation
  - Target first the rotator cuff for external rotation
  - Then target deltoids combined with external rotators
- Therapeutic exercises for strengthening
  - Started with isometrics
  - Assisted eccentric exercises
  - Progressed to active motions then added resistance

Manual therapy and breast cancer rehab

- Breast cancer patients benefit from a multi-modal approach that includes passive mobilization, myofascial techniques, and active exercise to increase ROM and decrease pain
- Breast cancer patients have been shown to benefit from treatment to myofascial interfaces

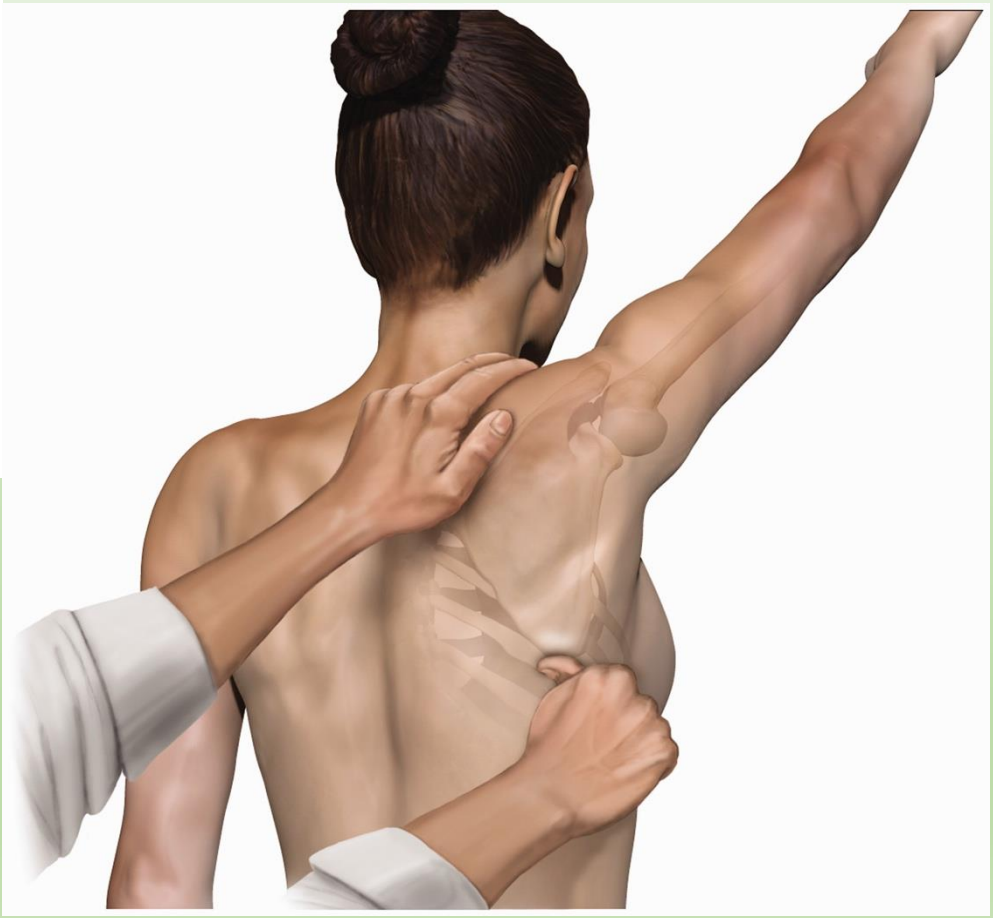


Mechanisms of Manual Therapy

- Manual therapy elicits neurophysiological responses
  - Pain inhibitory effect
    - Modifies discharge of neural afferents
    - Modulates sensory messages by inhibiting response of the dorsal horn neurons to nociceptive stimuli which alters pain processing
    - Alters pain receptor threshold
    - Changes pain processing of the central nervous system
- Potential for stimulation of neuroendocrine system
  - Some studies shown increase levels of dopamine and serotonin, in addition to increased natural killer cells and lymphocytes
    - Correlate with decreased pain levels
- Mobilizations stimulate peripheral mechanoreceptors and inhibit nociceptors

Soft Tissue Mobilization and Radiated Skin

Joint Mobilizations



Management of Shoulder Dysfunction

Impairment	High Irritability	Moderate Irritability	Low Irritability
Nociceptive pain	Activity modification Manual Therapy Exercise	Activity modification Manual Therapy Exercise	Exercise
Neurogenic pain	Aerobic exercise Gentle Manual Therapy Neural mobilization (gliding)		Aerobic Exercise Manual Therapy Neural mobilization (tension)
Nociplastic pain	Pain science education Low intensity exercise Manual Therapy		
Limited mobility	Manual Therapy PROM/AAROM	Manual therapy Stretching	Manual Therapy Stretching with longer durations, increase intensity
Motor control deficits	AROM with verbal, visual, and tactile cues	AROM with light resistance PNF	AROM with moderate resistance PNF

Where is JB now?

- After a prolonged course of physical therapy (6 months) she has full functional shoulder range of motion and strength
  - Some potential factors to her slow progression were:
    - Impaired healing from chemotherapy
    - Inflammatory response to radiation therapy
    - Prolonged tissue healing from radiation therapy

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Manual therapy considerations for adhesive capsulitis in the breast cancer population: a clinical perspective

Diana Garrett[a], Gary Kearns[b] and Steve Karas[c]

[a]Program Director of Physical Therapy Services, Women's Health and Wellness Institute at Providence Saint John's Health Center, Santa Monica, CA, USA; [b]Doctor of Physical Therapy (DPT) Program, Department of Rehabilitation Sciences,School of Health Professions, Texas Tech University Health Sciences Center, Lubbock, TX, USA; [c]Doctor of Physical Therapy (DPT) Program, College of Health Sciences, Chatham University, Pittsburgh, PA, USA

ABSTRACT

Adhesive capsulitis (AC) is common in women aged 40–60, overlapping with the population at higher risk for breast cancer. Many breast cancer survivors develop shoulder dysfunction, including AC, due to cancer treatments such as surgery, chemotherapy, and radiation, leading to pain, limited mobility, altered biomechanics, and soft tissue contracture. Despite the prevalence of AC in this population, clinical guidelines for its management remain underexplored. Manual therapy can play a key role in improving quality of life for these individuals.

Understanding the pain mechanisms – nociceptive, neuropathic, and nociplastic – can inform appropriate treatment strategies for breast cancer survivors with AC. This clinical perspective integrates manual therapy principles into the evaluation and management of AC in this population. As breast cancer cases continue to rise, clinicians must recognize the impact of cancer treatment sequelae on orthopedic conditions to optimize patient care.

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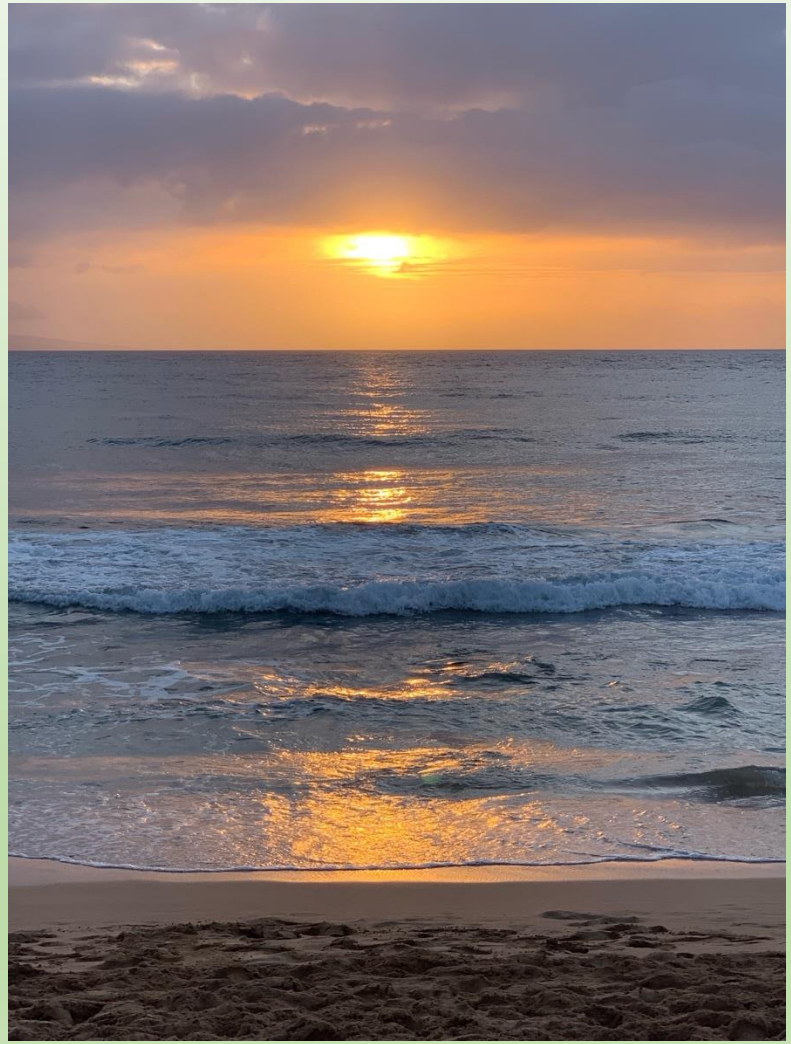
Thank you

DGarrettDPT@gmail.com



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