Hemiplegic Shoulder Pain:

Approach to Diagnosis & Management

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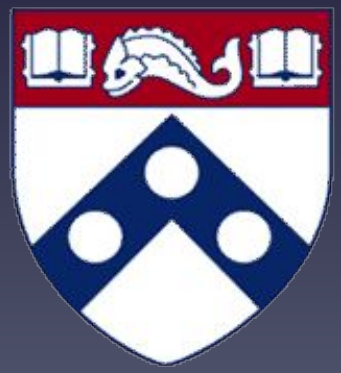


Disclosures

- None

Objectives

1. Identify the neurogenic and mechanical factors which contribute to HSP
2. Prescribe appropriate treatments for the identified factors in each patient with HSP
3. Understand the level of evidence supporting treatments for HSP

Outline

1. Basics
   - Definition, Incidence, Prognosis
2. Anatomy
3. Factors
   - Neurogenic
   - Mechanical
4. Diagnosis
5. Management
   - Suggested Treatment Algorithm

Basics

- CVA: 795,000 per year; 3rd for mortality, 1st for disability; costs $18.8 billion annually
- Hemiplegia: present in 50%, persists in 70%
- HSP: commonly reported 70% (range 16-84%)

Roger 2012; Aoyagi 2004; Bohannon 1986

HSP Risk Factors

- Impaired motor control
- Diminished proprioception
- Tactile extinction
- Abnormal sensation
- Elbow flexor spasticity
- Restricted ROM for shoulder abduction/ER
- Trophic changes
- Type 2 diabetes mellitus
- Adhesive capsulitis
- Complex regional pain syndrome
- Supraspinatus or long head biceps injury

Roosink 2011; Barlak 2009; Dromerick 2008

HSP Prognosis

- Lower Barthel score at 12 weeks
- Lower chance of return home
- Resolution within first 5 weeks predicts good long-term function

Roy 1994; Murie-Fernandez 2012; Higgins 2005

Anatomy

- Shoulder: complex ball-and-socket joint
  - Agility at the cost of stability
- Static stabilizers
  - Glenohumeral ligaments
- Dynamic stabilizers
  - Rotator cuff
  - Periscapular musculature

Kalichman 2011; Smith 2012

Mechanisms of Injury

- Cause is likely multifactorial
  - Weakness, spasticity, sensory loss, instability
- Classification
  - Better by etiology than symptoms

Neurogenic Factors

- Upper Motor Neuron (UMN) injury
  - Paralysis, spasticity, central post-stroke pain, central sensitization
- Lower Motor Neuron (LMN) injury
  - Peripheral neuropathy, brachial plexus injury, complex regional pain syndrome

UMN Disorders

- Weakness
  - Disrupts cervicothoraic posture, shoulder stability
- Spasticity
  - Overactive pectorals, subscapularis, biceps
  - 85% with spasticity had HSP (vs. 18% without)
  - Subscapular nerve block can reduce pain
- Brachial plexus injury
  - Traction injury suspected
  - Suprascapular and axillary nerves most affected

Van Ouwenaller 1986; Hecht 1992; Kaplan 1977; Moskowitz 1963; Chino 1980

UMN Disorders

- Complex Regional Pain Syndrome (CRPS)
  - Type 1 (previously RSD), Type 2 (causalgia)
  - Incidence up to 23% of all HSP cases
- Central post-stroke pain (CPSP)
  - Also termed thalamic pain syndrome, thought due to lesion in spinothalamic tract
  - Alterations in serotonin and norepinephrine

Van Ouwenaller 1986

Mechanical Factors

- Shoulder subluxation
- Rotator cuff injury
- Glenohumeral joint disorders
- Adhesive capsulitis
- Myofascial pain
- Direct trauma

Diagnosis

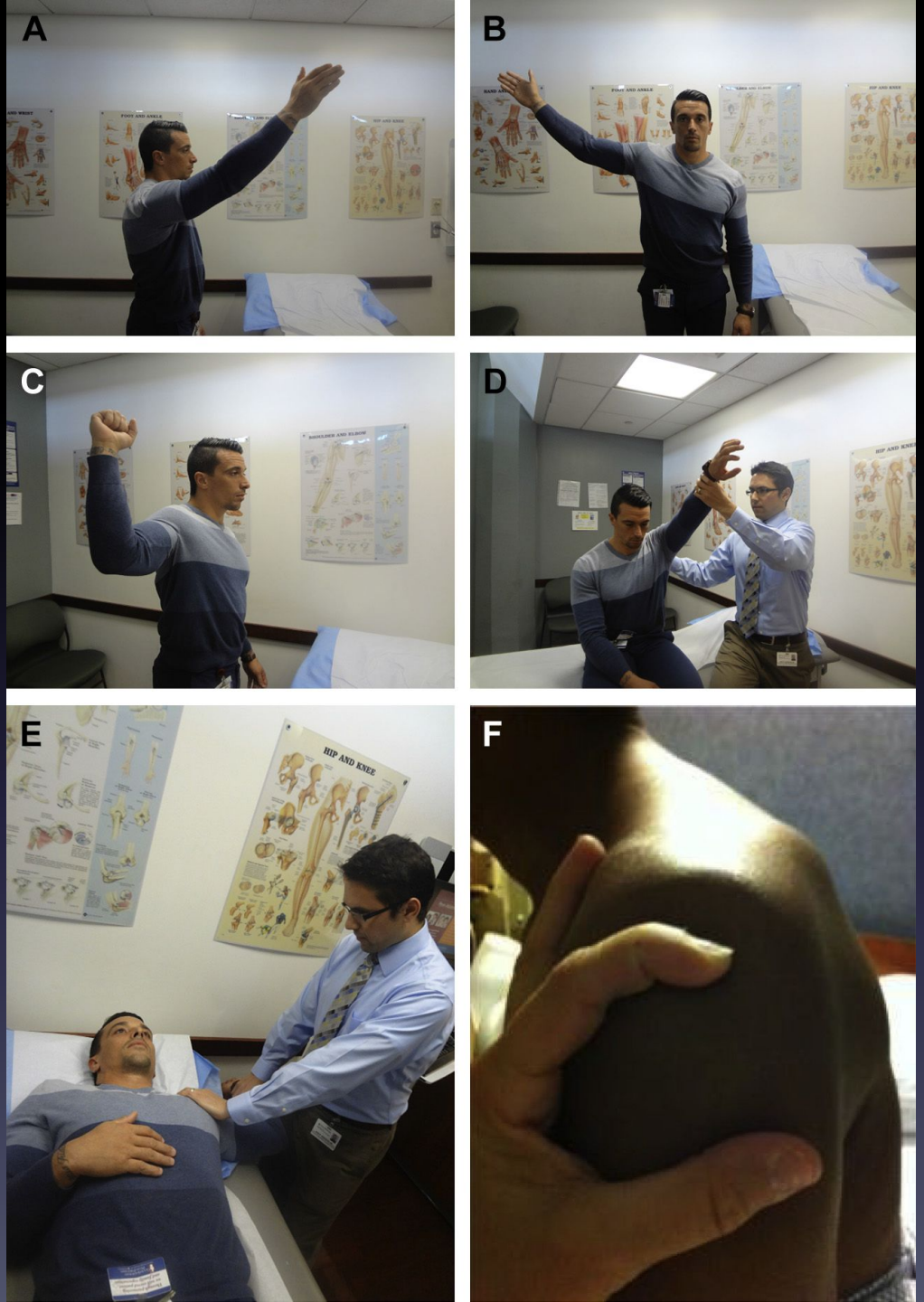
- History, physical examination, special tests/maneuvers
- Imaging (XR, MRI, US)
- Electrodiagnosis
- Diagnostic injections (nerve, muscle, joint)

Diagnosis: Exam

- Observation
- ROM
  - AROM, then PROM
- Palpation
  - Assess for bulk, focal tenderness
- Sensation
  - Dermatomes, peripheral nerves (e.g., axillary)
- Reflexes
  - C5-C8, UMN signs, spasticity
- Strength

Diagnosis: Exam

- Special tests
  - Neer, Hawkins, Jobe, O'Brien, HBB/HBN
  - Instability: Apprehension, Sulcus
- Diagnostic Injections
  - Nerve blocks (stellate ganglion, peripheral nerve)
  - Joint/tendon injections (GHJ, SA/SD bursa, etc)
  - Trigger point injections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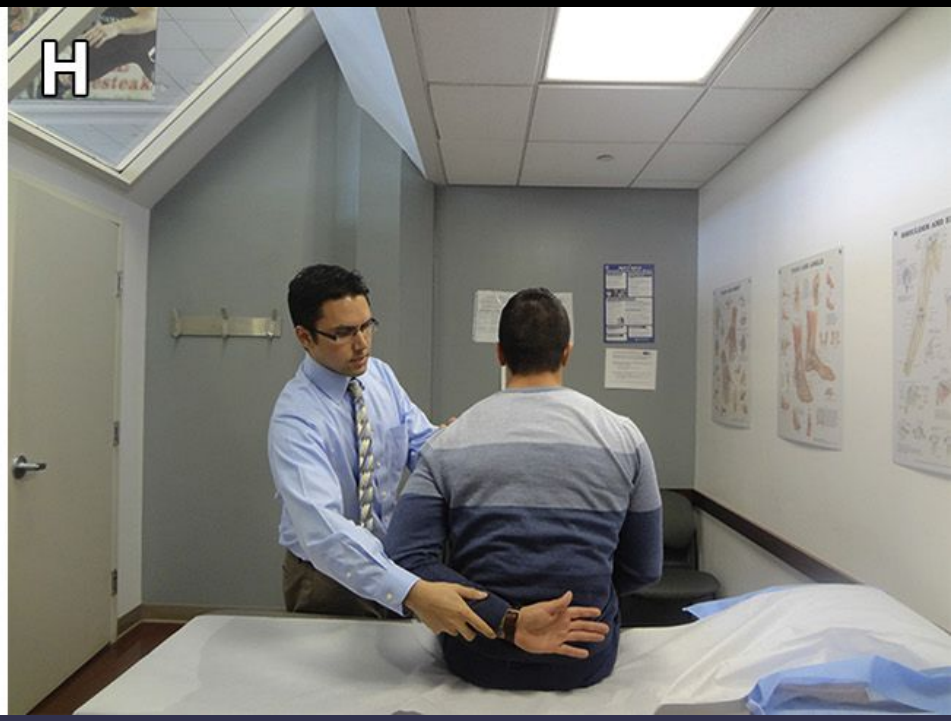
Key Exam Maneuvers



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Diagnosis: Imaging

- Radiography
  - AP: assess for fracture, subluxation
    - ER: calcific tendinopathy; IR: Hill-Sachs lesion
  - Scapular Y: acromial impingement
  - Axillary: shoulder instability
- Magnetic Resonance Imaging
  - Arthrography: labral tear, adhesive capsulitis
- Ultrasonography
  - May help assess for adhesive capsulitis
  - Advantage of serial assessments at low cost
  - More injuries noted for those admitted at Brunnstrom I-III vs IV-VI

Pong 2009; Huang 2010; Lee 2009

Diagnosis: Imaging

- Relationship of imaging and HSP
  - Lo *et al* study:
    - HSP cohort: 50% adhesive capsulitis, 44% shoulder subluxation, 22% rotator cuff tears, 16% CRPS Type 1
    - Arthrography helpful to detect adhesive capsulitis
      - Most cases within 2 months from CVA onset
  - MRI findings in chronic stroke: synovial capsule thickening/enhancement, rotator cuff enhancement
    - No difference in cuff tendinopathy, joint effusion, subacromial bursal fluid, ACJ arthrosis, muscle atrophy

Lo 2003; Tavora 2010

Management

- Prevention through positioning
  - Flaccid stage: risk for injury
  - Suggested: abduction, ER, flexion
    - But no consensus, none proven superior
- Strapping and slings
  - Tape perpendicular to inhibit, parallel to promote
    - Only small studies to support vs. sham taping
  - Slings and arm troughs help minimize shoulder subluxation
    - Improvements in HR, gait speed, decreased O2 rate with sling use in a cross-over study

Wanklyn 1996, Braus 1994, Murie-Fernandez 2012; Thelan 2008; Han 2011

Physical Therapy

- Mechanical Factors
  - PROM exercises within pain-free range can reduce reports of shoulder pain by 43%
  - Overhead pulley exercises increase cuff injury risk
  - Neither Bobath nor Brunnstrom superior
  - CPM: increased shoulder stability but no change to motor impairment, pain, tone, disability
  - Robotic devices: improved function at 8 months

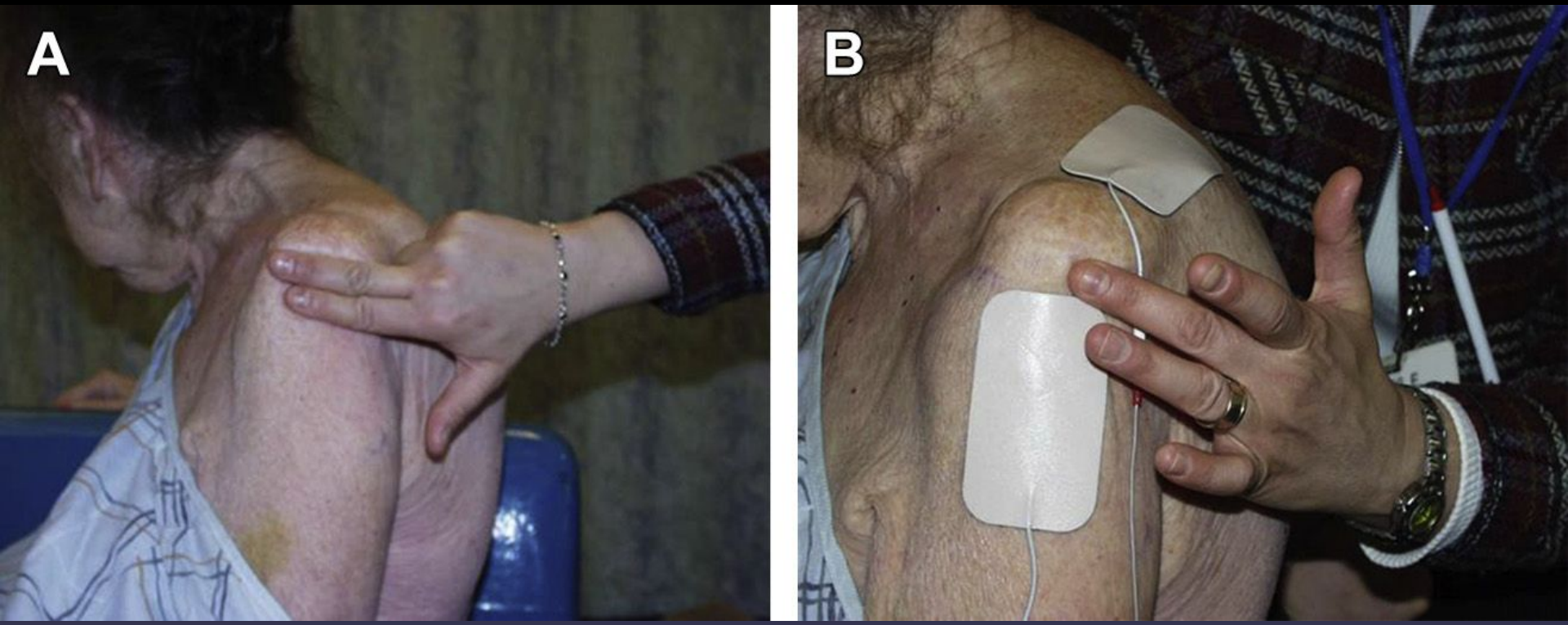
Caldwell 1969; Kumar 1990; Walsh 2001; Lynch 2005; Masiero 2007

Physical Therapy

- Neurogenic Factors
  - TENS: high intensity > low intensity or placebo
  - FES: to reduce shoulder subluxation/instability
    - More effective in acute vs chronic HSP after 6 wks Tx
    - FES + PT is superior to PT alone (RCT, n=50)
    - Cochrane: improves pain-free ROM and reduces subluxation, *does not* affect pain or impairment
    - Intramuscular FES: reduced pain at 1 year, but no change to strength/sensation

Leandri 1990; Walsh 2001; Want 2000; Koyuncu 2010; Price 2001; Chae 2005; David 2010

FES



Vasudevan & Browne 2014

Physical Therapy

- Neurogenic Factors
  - EMG biofeedback and relaxation: 150 min x 5 days biofeedback or 30 min x 2 days relaxation exercises led to improved ROM, tone, reduced pain at 2 weeks

Williams 1982

Interventional

- Neurogenic Factors
  - Botulinum toxin (presynaptic Ach inhibitor)
    - Several small studies show favorable results for both ROM and pain; others do not
      - One study vs corticosteroid
    - Some studies include intraarticular toxin
      - Nocioceptive effect?
  - Sympathetic blocks (for CRPS)
    - Central pain covered later in this talk
    - Rehab considerations: pain/edema control, isometric and stress-loading exercises, concurrent psychotherapy

Yelnik 2007; Kong 2007; De Boer 2008; Lim 2008; Castiglione 2011

Pharmacotherapy

- NSAIDs, topical lidocaine, antiepileptic agents, TCAs, SSRIs, antispasmodics
  - The problem: not a single good trial
- Corticosteroid injection
  - Glenohumeral joint or subacromial bursa
    - Can reduce pain and increase pain-free ROM
- Suprascapular nerve block
  - Potentially superior to corticosteroid at 1 month

Lakse 2009; Chae 2009; Dekker 1997; Snels 2000; Yasar 2011, Allen 2010

Complementary and alternative medicine

- Acupuncture
  - Works via neurohormonal mechanism: β-endorphin dynorphin A/B, substance P, noradrenaline
  - Benefit in addition to standard PT
- Aromatherapy: limited study

Shin 2007; Lee 2012; Shin 2007

Surgery

- Typically for adhesive capsulitis (release of capsular adhesions, manipulation under anesthesia) or rotator cuff tendinopathy (acromioplasty, repair)
  - HSP relieved in all 13 patients after contracture release in one small study

Braun 1971

Suggested Protocol

- Step 1: Identify neurogenic factors
- Step 2: Identify mechanical factors
- Step 3: Prevention through positioning
- Step 4: Symptom control and rehabilitation
- Step 5: pathology based intervention

Suggested Protocol

- Strapping/Taping: perpendicular to inhibit, parallel to promote
- Slings:
  - Flaccid: sitting, ambulating, transferring
  - Spastic: avoid prolonged use
  - Avoid axillary supports

Suggested Protocol

- Physical Therapy and Modalities
  - Strive for maximal pain-free ROM
  - Avoid overhead pulley exercises
  - TENS: best at high intensity
  - FES: apply to deltoid and supraspinatus for temporary reduction in shoulder subluxation
  - EMG biofeedback: to encourage early and active participation, maximize psychological control

Suggested Protocol

- Pharmacotherapy
  - Neurogenic:
    - Neuropathic pain: AEDs, TCAs, SSRIs
    - Spasticity: antispasmodics
  - Mechanical
    - NSAIDs and acetaminophen
    - Rare opioids or oral steroids

Suggested Protocol

- Injection therapy
  - Neurogenic:
    - Botulinum Toxin: IM, possibly even IA
    - Stellate Ganglion Block
  - Mechanical
    - Corticosteroid to GHJ or subacromial bursa
    - Suprascapular nerve block
    - Trigger point injections

Suggested Protocol

- Complementary and alternative medicine
  - Acupuncture may be superior in combination with standard PT than PT alone
  - Aromatherapy has limited positive support

Suggested Protocol

- Surgery (after 6 mos failed conservative Tx)
  - Neurogenic: release of contractures
  - Mechanical: capsular release, acromioplasty, rotator cuff repair

Summary

1. HSP is a common complication of CVA which is known to be associated with poor outcomes
2. HSP is a multifactorial process often encompassing a combination of neurogenic and mechanical factors
3. They key to management is prevention as able, and concurrent treatment of all contributing factors

Objectives

1. Identify the neurogenic and mechanical factors which contribute to HSP
2. Prescribe appropriate treatments for the identified factors in each patient with HSP
3. Understand the level of evidence supporting treatments for HSP

References

- Contact me for a list
  - john.vasudevan@uphs.upenn.edu
    - *Or see:* Vasudevan J, Browne B. Hemiplegic shoulder pain: An approach to diagnosis and management. *Phys Med Rehab Clin N Am.* 2014;25(2):411-437.

THANK YOU!