Hemiplegic Shoulder

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What is meant by “the hemiplegic shoulder”?

- pain
- subluxation
- loss of ROM

How common are these problems?

- Incidence of shoulder pain post-stroke is high
- In a recent prospective study, Gamble et al. (2002) reported that 52/152 (34%) developed shoulder pain following stroke, 28% by two weeks and 87% by two months. By 6 months, the pain had resolved in 80% of the patients.

What causes hemiplegic shoulder pain?

- Factors most frequently associated with shoulder pain are:
  - shoulder (glenohumeral) subluxation (Crossens-Sills and Schenkman 1985, Moskowitz et al. 1969b, Savage and Robertson 1982, Shai et al. 1984),
  - shoulder contractures or restricted shoulder range of motion (Bloch and Bayer 1978, Braun et al 1981, Fugl-Meyer et al. 1975, Crossens-Sills and Schenkman 1985, Hakuno et al. 1984, Risk et al. 1984) and
  - spasticity, particularly of the subscapularis and pectoralis muscles (Braun et al. 1981, Caldwell et al. 1969, Moskowitz 1969a, 1969b).
  - Other suggested causes include reflex sympathetic dystrophy (Chu et al. 1981, Davis et al. 1977, Perrigot et al. 1975), or injury to the rotator cuff (Najenson et al. 1971, Nepomuceno et al. 1974). The role of central post stroke pain in the etiology of shoulder pain is unclear (Walsh 2001).

What causes hemiplegic shoulder pain? Cont.

- Although many etiologies have been proposed for hemiplegic shoulder pain, increasingly it appears to be a consequence of spasticity and the sustained hemiplegic posture.

Shoulder Subluxation

Shoulder Subluxation Pathophysiology

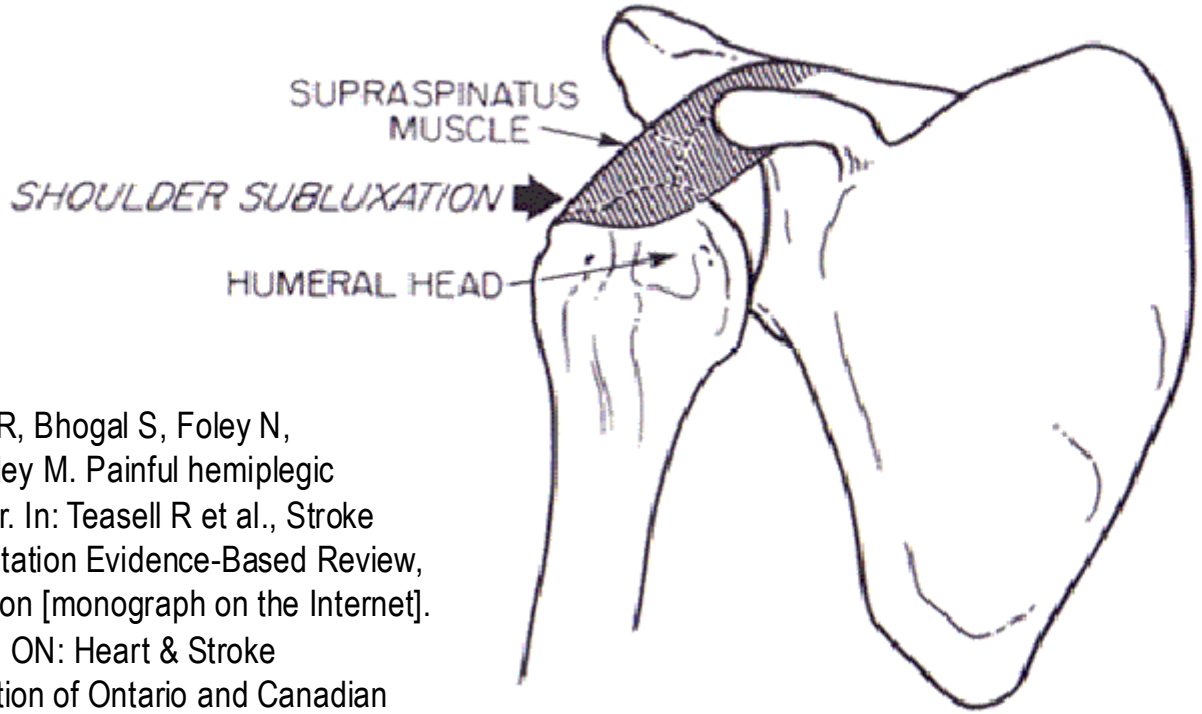
- The glenohumeral joint is multiaxial and has a range of motion, which exceeds that of other joints in the body.

- Stability is achieved through the rotator cuff. During the initial period following a stroke the hemiplegic arm is flaccid. Therefore the rotator cuff cannot maintain the humeral head in the glenoid fossa and there is a high risk of shoulder subluxation.

- The resulting mechanical effect is overstretching of the glenohumeral capsule (especially its superior aspect) and flaccid supraspinatus and deltoid muscles (Basmajian and Bazant 1959, Shahani et al. 1981).

Shoulder Subluxation Pathophysiology Cont.

Figure 11B. Shoulder subluxation. *During the initial phase of hemiplegia, the supraspinatus muscle is flaccid. The weight of the unsupported arm can cause the humeral head to sublux downward out of the glenoid fossa.*



Teasell R, Bhogal S, Foley N, Speechley M. Painful hemiplegic shoulder. In: Teasell R et al., Stroke Rehabilitation Evidence-Based Review, 6th edition [monograph on the Internet]. London, ON: Heart & Stroke Foundation of Ontario and Canadian Stroke Network; 2003 [cited 2005/03/30]. Available from: http://www.ebrsr.com

Clinical Practice Implication

- Shoulder subluxation is a very common problem in hemiplegic patients.

- During the initial flaccid stage the involved extremity must be adequately supported. Improper positioning in bed, lack of support while the patient is in the upright position or pulling on the hemiplegic arm when transferring the patient all contribute to glenohumeral subluxation. (Chaco and Wolf 1971).

Scapular Rotation and Shoulder Subluxation

There was no significant relationship noted between the orientation of the scapula and the severity of subluxation.

- Prevost et al. (1987), using a 3-D x-ray technique, studied the movement of the scapula and humerus in 50 stroke patients. They concluded that the scapular position was not an important factor in the occurrence of inferior shoulder subluxation.
- Culham et al. (1995) reported there was no correlation between the amount of subluxation and the scapular abduction angle or the humeral abduction angle.
- Price et al. (2001) compared patients with and without stroke (n=15) and reported that subluxation in stroke patients was unrelated to scapular resting position.

Pain in Shoulder Subluxation

- Shoulder subluxation may be a cause of shoulder pain; however, patients with shoulder subluxation do not necessarily experience pain and not all cases of hemiplegic shoulder pain suffer from subluxation.

- Although it has not been established that shoulder subluxation is the primary cause of hemiplegic shoulder pain it would still take care early on with the hemiplegic upper extremity to avoid subluxation.

Pain in Shoulder Subluxation

Table 11.13 Studies which Support or Fail to Report an Association between Shoulder Subluxation and Pain

Studies Supporting the Role of Shoulder Subluxation in Pain	Studies Which Fail to Support the Role of Shoulder Subluxation in Pain
Shai et al. 1984 Van Ouwenaller et al. 1986 Poulin de Courval et al. 1990 Roy et al. 1994 Chantraine et al. 1999 Aras et al. 2004	Peszczynski & Rardin 1965 Bohannon 1988 Vangenberge & Hogan 1988 Bohannon & Andrews 1990 Kumar et al. 1990 Arsenault et al. 1991 Joynt 1992 Zorowitz et al. 1996 Ikai et al. 1998

Teasell R, Bhogal S, Foley N, Speechley M. Painful hemiplegic shoulder. In: Teasell R et al., Stroke Rehabilitation Evidence-Based Review, 6th edition [monograph on the Internet]. London, ON: Heart & Stroke Foundation of Ontario and Canadian Stroke Network; 2003 [cited 2005/03/30]. Available from: http://www.ebrsr.com

Spasticity, Contractures and Hemiplegic Shoulder Pain (HSP)

Spasticity and Hemiplegic Shoulder Pain

- Van Ouwenaller et al. (1986) studied 219 patients followed for one year after a stroke and identified a much higher incidence of shoulder pain in spastic (85%) than in flaccid (18%) hemiplegics.

- Poulin de Courval et al. (1990) examined 94 hemiplegic subjects and reported that subjects with shoulder pain had significantly more spasticity of the affected limb than those without pain.

- In contrast, Bohannon et al. (1986) conducted a statistical analysis of 50 hemiplegic patients and asserted that "*spasticity ... was unrelated to shoulder pain*." Joynt (1992) also supported this finding after examining 67 stroke patients.

- Nevertheless, evidence for spasticity in particular hypertonic muscle imbalance, as a cause of hemiplegic shoulder pain is growing.

Frozen or Contracted Shoulder

- A frozen or contracted shoulder is characterized by limitations in range of movement, with a pattern of restriction.

- This condition is a frequently identified source of pain in the spastic hemiplegic shoulder (Bohannon et al. 1986, Eto et al. 1980, Fugl-Meyer et al. 1975, Grossens-Sills and Schenkman 1985, Hakuno et al. 1984, Risk et al. 1984).

Spasticity and hemiplegic shoulder pain cont.

Conclusions:

- There is an association between spasticity and the development of hemiplegic shoulder pain.

- Spasticity and subsequent frozen shoulder are the most likely causes of hemiplegic shoulder pain.

Spastic Muscle Imbalance

- Hemiplegia is characterized by typical posturing reflecting hypertonic muscle patterns. Flexor tone predominates in the hemiplegic upper extremity and results in scapular retraction and depression as well as internal rotation and adduction of the shoulder. This leads to spastic muscle imbalance about the shoulder joint. Clinically the internal rotators of the shoulder predominate after a stroke and external rotation is one of the last areas of shoulder function to recover.

- A shortened agonist in the synergy pattern becomes stronger and the constant tension of the agonist can become painful. Stretching of these spastic muscles causes more pain. Shortened muscles inhibit movement, reduce range of motion.

- Muscles that contribute to spastic internal rotation /adduction of the shoulder include the subscapularis, pectoralis major, teres major and latissimus dorsi. However, the subscapularis and pectoralis major have been implicated as most often being spastic leading to muscle imbalance.

Subscapularis Spasticity Disorder Pathophysiology

- The subscapularis spasticity disorder is characterized by motion being most limited and pain being reproduced on external rotation. A tight band of spastic muscle is palpated in the posterior axillary fold.

- Normally, nerve impulses to the subscapularis are inhibited during arm abduction to allow the humerus to externally rotate, thus preventing impingement of the greater tuberosity on the acromion (Codman 1934).

- As part of the typical flexor synergy pattern in spastic hemiplegics, the subscapularis are tonically active. This limits shoulder abduction, flexion and external rotation.

Subscapularis Spasticity Disorder

- Inaba and Piorkowski (1972) reported external rotation was the most painful and limited movement of the hemiplegic shoulder.

- Bohannon et al. (1986) found limitation of external rotation of the hemiplegic shoulder was the factor which most correlated with hemiplegic shoulder pain.

- Hecht (1995) has noted, "*The subscapularis muscle is the primary cause of shoulder pain in spastic hemiplegia where external rotation is most limited…the subscapularis is the keystone of the abnormal synergy pattern*."

Pectoralis Spasticity Disorder

- This disorder is characterized by motion being most limited and pain produced on abduction. A tight band of spastic muscle can be palpated in the anterior axillary fold (Hecht 1995). It is also noteworthy that the pectoralis major is a synergist of the subscapularis.

Rotator Cuff Disorders

- Generally, hemiplegic shoulder pain is not commonly associated with rotator cuff disorders (Risk et al. 1984, Nepomuceno and Miller 1974, Najenson et al.1971).

Management of the Painful Hemiplegic Shoulder

Management of the Hemiplegic Shoulder Pain (HSP)

- Management of HSP, once the condition has developed, is difficult and response to treatment is frequently unsatisfactory (Risk et al. 1984).

- The best treatment approach has not been definitely established. As a result, a wide variety of treatments have been used, with varying degrees of success (Snels et al. 2002).

- Early passive shoulder range of motion, and supporting and protecting the involved shoulder, in the initial flaccid stage are regarded as important steps to reduce the development of shoulder pain.

Positioning of the Hemiplegic Shoulder

- The muscles around the hemiplegic shoulder are often paralyzed, initially with flaccid tone and later with associated spasticity.

- Careful positioning of the shoulder serves to minimize subluxation and later contractures as well as possibly promote recovery, while poor positioning may adversely affect symmetry, balance and body image.

Positioning of the Hemiplegic Shoulder

- Gilmore et al. (2004), Davies (2000) suggests that through careful and correct positioning, the development of shoulder pain can be prevented.

- Bender and McKenna (2001) noted that the "***recommended position for the upper limb is towards abduction, external rotation and flexion of the shoulder*,"** however, from Carr and Kenny (1992) review, Bender and McKenna cite that "*most popular theories failed to yield consensus for exact degrees of the positioning*."

Positioning of the Hemiplegic Shoulder

Conclusions:

- There is consensus (Level 3) opinion that proper positioning of the hemiplegic shoulder helps to avoid subluxation.

- However, there is conflicting (Level 4) evidence that prolonged positioning does not influence active and passive range of motion or level of pain.

Slings and Other Aids

- Arm slings are often used in the initial stages following a stroke to support the affected arm. However, their use is controversial.
- Arm slings can have disadvantages in that they encourage flexor synergies, inhibit arm swing, contribute to contracture formation and decrease body image causing the patient to further avoid using that arm.
- However, a sling remains the best method of supporting the flaccid hemiplegic arm while the patient is standing or transferring. As tone returns to the shoulder muscles, the risk of shoulder subluxation decreases and slings can then be withdrawn.
- Ada et al (2005) conducted a systematic Cochrane review and concluded that there is insufficient evidence that these devices reduce or prevent shoulder subluxation following a stroke.

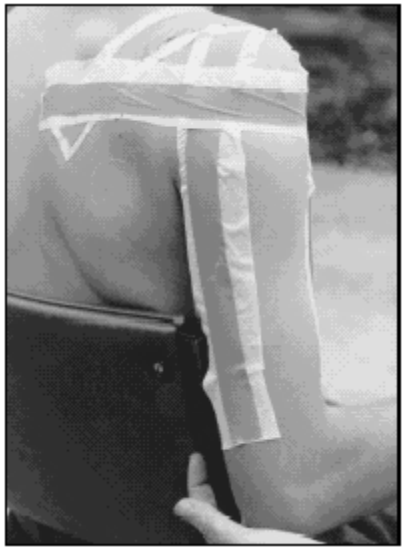
Strapping the Hemiplegic Shoulder

Strapping the hemiplegic shoulder does not appear to improve upper limb function (Level 1b evidence), but may reduce pain (Level 4 evidence).

Strapping the Hemiplegic Shoulder

an example of tape strapping

(N.B. <u>no</u> evidence that it works)



HC Hanger, P Whitewood, G Brown, MC Ball, J Harper, R Cox and R Sainsbury. A randomized controlled trial of strapping to prevent post-stroke shoulder pain. Clin Rehabil 2000; 14: 370–80.

Active Therapies in the Hemiplegic Shoulder

- The association of spasticity, muscle imbalance and a frozen shoulder with shoulder pain suggests that a therapeutic approach designed to improve range of motion of the hemiplegic shoulder will improve pain.

Active Therapies in the Hemiplegic Shoulder

Conclusions

- There is moderate (Level 1b) evidence that aggressive range of motion therapies, using overhead pullies results in increased rates of shoulder pain. (Kumar et al. 1990)

- There is moderate (Level 1b) evidence that Bobath therapy for the hemiplegic shoulder is associated with greater pain reduction than passive cryotherapy. (Partridge et al. 1990)

- There is moderate (Level 1b) evidence that static positional stretches performed daily are associated with increasing pain and decreasing range of motion. ((Gustafson & McKenna 2006).)

Active Therapies in the Hemiplegic Shoulder Cont.

- There is moderate (Level 1b) evidence that gentle exercises to improve range of motion are the preferred approach. There is moderate (Level 1b) evidence that adding ultrasound therapy to range of motion exercises does not change outcomes.

- Range of motion exercises should not carry the shoulder beyond 90 degrees of flexion and abduction **unless there is upward rotation of the scapula and external rotation of the humeral head** (Gresham et al. 1995).

Hemiplegic shoulder

"Range of motion exercises for the more affected upper extremity. The therapist carefully mobilizes the scapula during arm elevation."

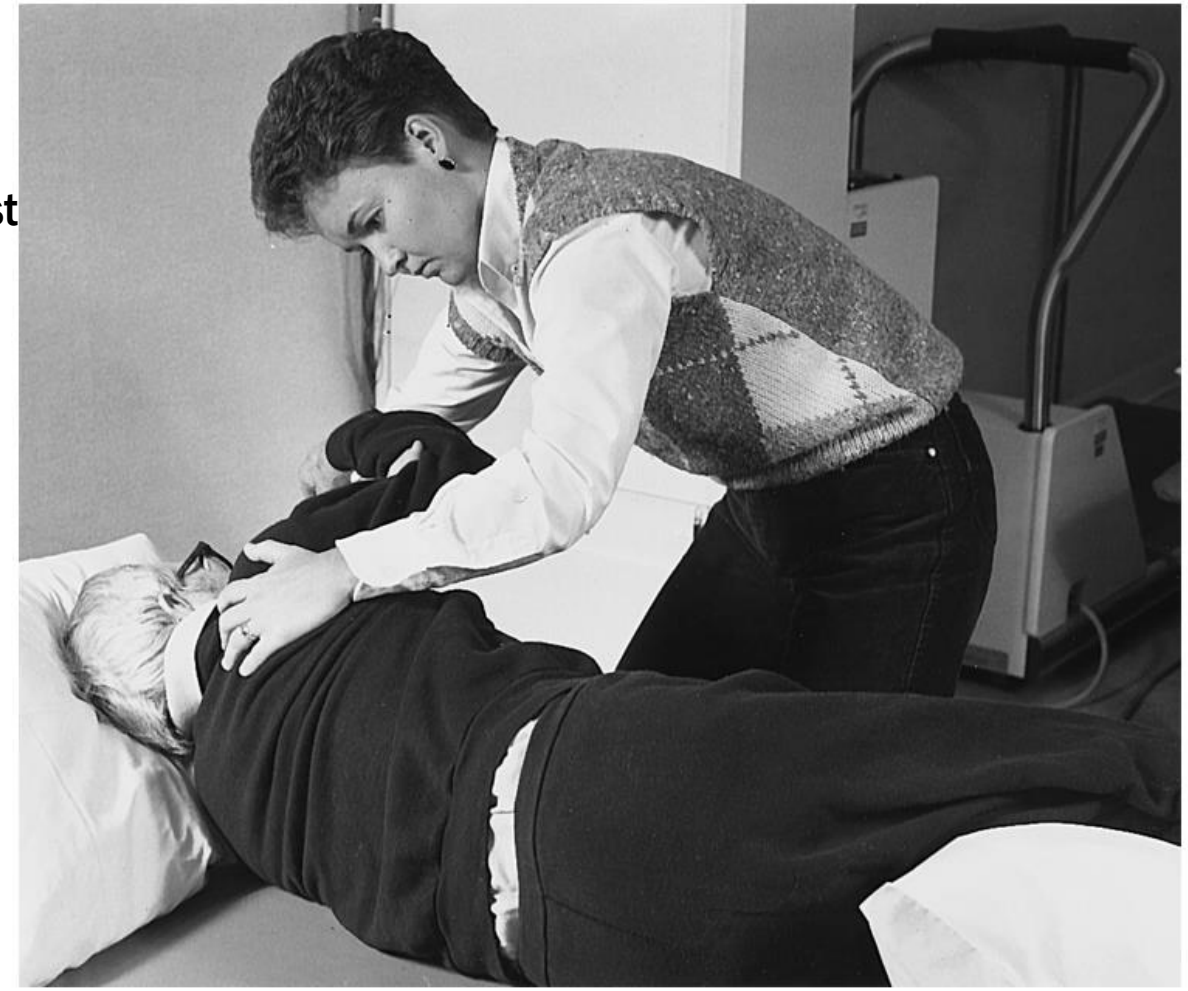


Image from: O'Sullivan SB. Stroke. In: O'Sullivan SB, Schmitz TJ, eds. Physical Rehabilitation, 5th ed. Philadelphia, PA: F.A. Davis, 2007: 705-776. [This image is in Figure 18.6]

Injections in the Hemiplegic Shoulder

Conclusions

- There is moderate (Level 1b) evidence that corticosteroid injections do not improve shoulder pain or range of motion in patients with hemiplegia. (Snels et al. 2000)

Functional Electrical Stimulation (FES) in the Hemiplegic Shoulder

- Gresham et al. (1995), the U.S. AHCPR Post Stroke Rehabilitation Guidelines defines FES as *"bursts of electrical stimulation applied to the nerves or muscles affected by the stroke, with the goal of strengthening muscle contraction and improving motor control."*
- The ideal intensity of treatment is thought to be 6 hours daily, five days a week for 6 weeks. FES is performed at frequencies of between 35 to 50 Hz (Paci et al. 2005).
- Paci et al. (2005). Suggests that the supraspintus and posterior deltoid muscles are most likely to be treated as they are important muscles in maintaining the correct alignment of the glenohumeral joint.
- Theoretically, FES should help to compensate or facilitate flaccid shoulder muscles, which in turn should reduce the risk of shoulder subluxation.

Functional Electrical Stimulation (FES) in the Hemiplegic Shoulder

- Price & Pandyan (2001) conducted a systematic review and concluded that there was evidence that FES, in addition to conventional therapy, improves function but is not superior for preventing pain.

- Ada & Foongchomcheay (2002) also conducted a meta-analysis, which included the results from 6 RCTs and suggested that early treatment following stroke helps to prevent the development of hemiplegic shoulder while later treatment helps to reduce pain, in addition to conventional therapy.

Functional Electrical Stimulation (FES) in the Hemiplegic Shoulder

- However, Church et al. (2006) suggested that FES treatment might actually be associated with harm and may worsen arm function, especially among those with severe paresis.

- Generally, most of the RCTs reviewed reported a **benefit associated with FES treatment**, although there was variability in the outcomes assessed: range of motion, muscle tone, EMG activity, shoulder subluxation, shoulder pain and muscle function. The results suggest that FES can reduce pain in the affected shoulder and also improve upper extremity function.

Surgery as Treatment for Muscle Imbalance

- There is limited (Level 2) evidence that surgically resecting the subscapularis and pectoralis muscle tendons improves pain and range of motion in stroke patients. Further research is needed to confirm these findings.

Motor Blocks as Treatment For Muscle Imbalance

- Deinnervation of the subscapularis muscle may reduce shoulder pain and improve passive range of motion (Level 1b evidence), more so than deinnervation of the pectoralis major muscle (Level 4 evidence).

Miscellaneous Treatments for Shoulder Pain

- There is moderate (Level 1b) evidence that aromatherapy combining with acupressure can reduce hemiplegic shoulder pain.

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