

Managing hemiplegic shoulder pain

Hemiplegic shoulder pain is a serious complication post stroke that can adversely affect a patient's ability to participate in the rehabilitation process. Described as a painful and stiff shoulder, the underlying diagnosis can be variable and the management challenging. **Drs Sudhir Singh, Sebastian Francis, Syed Hasan and Bhaskar Mandal** look at the causes, associations and management techniques involved.

Stroke is the second most common cause of death in industrialised countries¹. One-third of survivors remain dependent or bedridden, one-third make a full recovery and a third are left with variable degree of functional incapacity². Complications following stroke, including hemiplegic shoulder pain (HSP), adversely affect patient participation in the rehabilitation process. HSP is used to describe a variety of diagnoses, as its causes have not been clearly identified.

Functional shoulder joint anatomy

The shoulder is a ball and socket joint allowing a wide range of movements. There are protective mechanisms to prevent and minimise local damage. The rotator cuff muscles act as a lever for elevation during abduction, lowering the humeral head away from the acromion and reducing the repetitive damage to the supraspinatus tendon. Weakening of these muscle groups will lead to impingement and inflammation of the rotator cuff.

Incidence and aetiology

The incidence of HSP in the literature varies between five per cent and 84 per cent³. Differences in study design, duration of study,

definition of pain and the time from onset of stroke to assessment may explain the wide variation, as would the population studied (ie, acute and chronic stroke populations). Hemiplegia disturbs the normal mechanics of the shoulder joint due to absence of movement or loss of motor control leading to damage due to malpositioning and traction injury. This may be further complicated by development of abnormal movements and secondary changes in the surrounding soft tissues and glenohumeral joint subluxation.

Ryerson and Levit have classified shoulder pain in hemiplegia into four groups⁴:

- > joint pain – a misaligned joint gives rise to sharp and stabbing pain on active and passive movements;
- > pain arising from a spastic muscle being suddenly stretched will feel like a pulling sensation;
- > a diffuse aching pain may result from altered sensitivity following stroke;
- > reflex sympathetic dystrophy – this involves the whole limb and has a typical diffuse onset of pain.

The precise aetiology of HSP remains ill

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understood but some or all of the following may contribute.

Central post stroke pain

Cerebrovascular events involving the thalamic region cause symptoms of burning and freezing. Allodynia, or pain from noninjurious stimuli, is characteristic of central post stroke pain, which is difficult to treat. It may respond to adrenergically active antidepressants such as amitriptyline.

Reflex sympathetic dystrophy

The pathophysiology of this autonomic dysfunction is not fully understood, though imbalances in the central neural control of the sympathetic system may result in immobility and abnormal sensation. The incidence varies between 12.5 per cent and 28 per cent³. The initial presentation is with pain and reduced range of movement, eventually leading to joint stiffness. Other features include vasomotor changes (sweating and colour alteration), trophic changes and oedema. Radiographic changes include osteoporosis.

Brachial plexus lesion

It is feasible that injury to the brachial plexus or peripheral nerves can lead to shoulder pain but whether hemiplegic patients suffer from this type of injury has not been proven.

Rotator cuff tears

This condition causes pain on resisted external and internal rotation related to supraspinatus and subscapularis tendon tears respectively. Najenson *et al* noted that rotator cuff tears were more prevalent on the hemiplegic side (40 per cent) as compared to the unaffected side (16 per cent)⁵. However, other researchers have not been able to reproduce these results. This may be due to variation in the population studied. The more severe the paralysis, the more likely it is to lead to a rotator cuff tear.

Adhesive capsulitis

Adhesive capsulitis causes a deep aching pain with marked reduction in movement. It can occur in paralysed patients as a result of disuse, spasticity and contractures.

Subluxation

Inferior subluxation may be caused by flaccidity, which then leads to pain and discomfort due to tension on the joint capsule and ligaments.

Factors associated with HSP

HSP is neither related to age or sex; studies have shown HSP to be strongly linked to the degree of spasticity and range of movements. Van Ouwenaller *et al* found 85 per cent of their sample of 219 patients to have shoulder pain related to spasticity as opposed to 18 per cent related to flaccidity⁶. It is presumed that spasticity, predominantly of the supraspinatus muscle, causes medial rotation leading to traction on the periosteum at the site of muscle attachment, leading to pain. Incidence of pain also seems to be related to the severity of weakness⁷. In one study of patients with severe paralysis, 84 per cent were found to suffer from moderate to severe pain⁵.

HSP is linked to the length of time post stroke. The progressive change in tone over time, and the reduction in the range of movement, alter the alignment of the joint. This leads to soft tissue injury and contractures. Roy *et al* in their study of 76 acute stroke patients showed the highest incidence of HSP at 10 weeks following stroke and the lowest at one week post stroke⁷. The shoulder joint can also be damaged by poor handling technique during rehabilitation.

Hemiplegic shoulder pain has a detrimental effect on the entire rehabilitation process. It is a source of anxiety for the patient and leads to poor participation in the rehabilitation programme, particularly that involving upper limb exercises. This leads to a longer stay in hospital. Patients with pain on shoulder movement spent an average of 82 days in hospital as compared with 39 days for patients with no shoulder pain⁷. HSP may also be associated with a lower Barthel score at the time of discharge from hospital. In one study 59 per cent of patients with a Barthel Index score of less than 15 had experienced HSP as compared to 25 per cent of those with Barthel Index score in excess of 15⁸.

Assessment

A focused history that has particular emphasis on

type of pain, exacerbating and relieving factors, and duration – followed by examination looking for evidence of subluxation, oedema, tenderness, contractures, atrophy and an assessment of the range of movement – will go a long way in establishing the diagnosis as well as establishing the likely underlying cause. A plain radiograph of the shoulder may be needed to exclude any bony injury and may be helpful in diagnosing a subluxed joint.

Treatment and prevention

The different aetiologies of HSP have led to considerable difficulties in formulating and implementing treatment protocols. There is a consensus, however, that measures should be in place, from the onset of stroke, to prevent the occurrence of HSP. These measures need to be observed by all health care professionals and the informal carers should also be made aware of these. This awareness has been known to reduce the incidence from 27 per cent to eight per cent⁹.

Position and handling

Improper positioning and handling are known to cause HSP by misalignment, subluxation and rotator cuff tears. The positioning of the hemiplegic shoulder is of utmost importance. If properly done it can prevent the occurrence of spasticity. The most favourable position for the shoulder is flexed, abducted and externally rotated. There is no consensus, however, regarding the position of the elbow.

Slings and supports

Shoulder slings are employed with the view that they will reduce the effect of gravity, thus limiting or preventing subluxation. There is scant evidence of this in the literature, but there are a number of studies of different types of slings. Harn's sling keeps the shoulder in a position of abduction and internal rotation with elbow flexed and was found to be almost twice as effective as the Bobath sling and support¹⁰.

Slings have not been accepted universally. Concerns have been raised regarding the effect of the sling on the range of movement, distorted body image and development of flexor tone.

Immobile patients able to sit up should be nursed with arm troughs or lap trays. This provides support to the flaccid upper arm and reduces

subluxation. The arm trough also positions the upper limb away from the body and inhibits internal rotation. Worn support devices – such as arm slings, axillary supports and humeral cuff supports – have also found a role in the treatment of HSP. The aim is to reduce subluxation and tension in the shoulder capsule and prevent the hypotonic limb from repeated trauma against the body. Unfortunately, they also lead to immobility, which can lead to contracture formation.

Strapping has, in general, been used to encourage normal alignment. However, it is limited by the need for trained therapist to apply it and by skin irritation, the former being very pertinent in community setting where there is a dearth of trained therapists.

Physiotherapy

Physiotherapy in the form of passive range exercises is advocated to prevent immobility and contracture formation. It also helps to restore functional range of movement and, arguably, patients' confidence. Normal range of movement is reduced in older population and 100 degree flexion, 90 degree abduction, 30 degree lateral rotation and 70 degree medial rotation is considered a realistic goal.

Kumar *et al* studied the use of overhead pulleys, skateboard and assisted shoulder movements. Their study showed overhead pulleys were associated with increased risk of rotator cuff tears¹¹. It is important that all patients attain optimal passive functional range of movement in the rehabilitation programme. This should be a pain free range of movement. Caldwell *et al* showed that exercises within the pain free range led to pain reduction in 43 per cent of patients¹².

HSP can be viewed as a local mechanical problem or a neurological problem. Local therapies include heat or cold applications, slings and supports and positioning. In the UK, physiotherapists frequently use the Bobath approach, which is a holistic neurologically-based approach¹³. This technique involves positioning the affected limb and moving it at all times in a pattern that is directed away from any abnormal increase in muscle tone. This ensures that normal tone is maintained and prevents the development of abnormal movement pattern. There may be little to choose between the two and the choice may boil down to local expertise.

FES and TENS

Functional electrical stimulation (FES) aims to maintain tone and reduce atrophy of muscle. The posterior deltoid or supraspinatus are the muscles usually stimulated. Studies have shown that FES will reduce both pain and subluxation with good functional activity^{14,15}. However, Wang *et al* have shown FES may only be effective in reducing subluxation within 21 days of stroke¹⁶ and Lin *et al* noted subluxation was likely to recur on discontinuation of FES¹⁷.

Transcutaneous electrical stimulation (TENS) has also shown encouraging results. TENS delivers electrical impulses across the skin as a way of treating pain. It is thought to act by stimulating touch fibres without activating the nociceptive fibres that provide pain relief in a manner similar to rubbing the site of pain. In addition, TENS is said to stimulate the production of endorphins. High intensity TENS patients gain significant benefit with increased passive flexion, extension and abduction¹⁸.

Pharmaceutical options

Simple analgesics like paracetamol and non-steroidal anti-inflammatory drugs are frequently prescribed as first-line treatment. There is no evidence base for the efficacy of these medications for HSP. However, it may be prudent to prescribe these medications if there are no contraindications.

Spasticity can lead to pain. Baclofen (a GABA receptor agonist) reduces spasticity and flexor spasms, particularly those of spinal origin.

Key points

- > There are many causes of shoulder pain, both central and local, following stroke.
- > It has a detrimental effect on patient's morale and jeopardises the entire rehabilitation process.
- > Assessment should include a focused history, local examination, including evaluation of range of movement and plain x-ray, if necessary, to exclude bony injury.
- > Measures should be in place from onset of stroke to prevent, detect and manage HSP.

Dantrolene is useful for spasticity of cerebral origin. Injections (alcohol, phenol or botulinum toxin) are alternatives in controlling focal spasticity.

Central post stroke pain is difficult to treat. The mainstay of treatment remains tricyclic antidepressants. Other drugs, which have been found to be effective, include anticonvulsants (carbamazepine, valproate, gabapentin) and antiarrhythmics (mexiletine). Patients need to be made aware that these drugs may take weeks to work; otherwise compliance is likely to be poor.

Rotator cuff lesions may improve with local steroid injections. Physicians will need to be selective in their choice of patients for steroid injection as it may lead to atrophy, local muscle weakness and delayed functional recovery. Reflex sympathetic lesions are best treated with steroids. Second-line treatment being stellate ganglion blocks and physiotherapy. Braus *et al* noted that 31 out of their 36 patients improved with low dose steroids⁹.

Conclusion

HSP is a common and serious problem. The aetiology remains poorly understood. The pain may arise from the joint or muscle, or be due to altered sensitivity. Many factors have been associated with HSP, including severity of paralysis, inappropriate handling and shoulder subluxation.

In the initial flaccid state following stroke, the arm needs to be supported but slings and supports remain controversial. Physiotherapy can prevent poor arm posturing and contracture formation. Simple analgesia remains a good first-line pharmacological option. Tricyclic antidepressants have a role in central post stroke pain and spasticity will improve with baclofen. Botulinum is an interesting option but more work is needed to establish its role in HSP. Steroids remain useful for inflammatory conditions and FES has shown promise in reducing subluxation.

Further work will need to focus on prevention along with education of relatives and health professionals on patient handling. More studies are required to establish the role of FES and the use of slings and strapping.

Conflict of interest: none declared.

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