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BestPractice

Evidence Based Practice Information Sheets for Health Professionals

The prevention and management of shoulder pain in the hemiplegic patient

Information Source

This *Best Practice* information Sheet has been derived from a systematic review of research entitled "The prevention and management of shoulder pain in the hemiplegic patient". The primary references on which this information sheet is based are available from the Joanna Briggs Institute or in the systematic review report published by and available from Blackwell Publishing Asia.[1]

Background

Functional disability post-cerebral vascular accident

This sheet focuses exclusively on the shoulder during rehabilitation. Following the acute phase of a cerebral vascular accident (CVA) the patient enters a rehabilitative phase that will ultimately impact on their residual functional ability. During this rehabilitative phase common complications include shoulder pain and subluxation of the glenohumeral joint. These complications have the potential to impact on the return of upper extremity function and in turn residual functional disability.

This Information Sheet Covers the Following Interventions:

1. Functional disability
2. Shoulder pain
3. Subluxation
4. Prevention interventions
5. Treatment interventions

Shoulder pain

Shoulder pain is probably the most common complication associated with hemiplegia and has the potential to delay rehabilitation as the painful joint may mask improvement in motor function. As many as 72% of patients with hemiplegia experience shoulder pain at least once during their rehabilitation, although approximately half of these cases do not recur. Shoulder pain may also limit the ability of a person with hemiplegia to reach their maximum functional potential. A correlation has been demonstrated between shoulder pain and shoulder range of movement. Suggested causes of shoulder pain include lesions of the rotator cuff tendon, subluxation, spasticity, central post-stroke pain, reflex sympathetic dystrophy syndrome (shoulder-hand syndrome), joint trauma during passive range of movement activities and brachial plexus injury. Unreliable diagnostic criteria and variable study methods make the confirmation of aetiologies difficult as important clinical associations, including upper-limb weakness and abnormal shoulder joint examination due to malalignment or degeneration, need to be taken into consideration.

Levels of Evidence

All studies were categorised according to the strength of the evidence based on the following revised classification system.[2]

Level I Evidence obtained from a systematic review of all relevant randomised controlled trials.

Level II Evidence obtained from at least one properly designed randomised controlled trial.

Level III.1 Evidence obtained from well-designed controlled trials without randomization.

Level III.2 Evidence obtained from well-designed cohort or case-control analytical studies preferably from more than one centre or research group.

Level III.3 Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled experiments.

Level IV Opinion of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

A relationship between shoulder pain and spasticity has been directly indicated in some studies, with shoulder pain occurring more often in those with spastic hemiplegia (85%) compared to those with flaccid hemiplegia (18%). However this view is contradicted by other studies. One study identified adhesive capsulitis as the main cause of shoulder pain, although the definition of this diagnosis was unclear. In terms of the development of shoulder pain, one study found it was already present in 67% of patients with hemiplegia when they were first admitted to a rehabilitation facility from acute care and that this pain worsened in the rehabilitation facility. These researchers highlighted the importance of early recognition and implementation of specific interventions for the shoulder pain in both the acute care and rehabilitation settings.

Subluxation of the glenohumeral joint

Subluxation of the glenohumeral joint is a well-recognised and frequent complication experienced by people with hemiplegia. The actual incidence of shoulder subluxation reported in the literature is highly variable. This may relate to issues such as whether diagnosis was based on clinical or radiological examination and the time interval between onset of hemiplegia and examination. Glenohumeral subluxation occurs more often during the flaccid stage of paralysis post CVA. It has been suggested that decreased muscle tone that occurs during this flaccid stage may result in a downward rotation of the scapular with a resultant compromise to the locking mechanism normally provided by the upward tilt of the glenoid.

However, biomechanical studies also propose that scapular and humeral orientation may differ depending on the stage of motor recovery and degree of spasticity.

The presence of shoulder pain post CVA is not limited to patients with subluxation of the shoulder complex and studies have not found a strong relationship between pain and subluxation. One study found no correlation between the grade of subluxation and the degree of shoulder pain, while another found patients with hemiplegia and shoulder pain had significantly more severe subluxation of the affected shoulder. Another study found shoulder pain was related more to loss of motion than to subluxation.

In summary, shoulder pain and subluxation are both common complications post CVA. Although studies to date have found no definitive correlation between shoulder pain and subluxation, the latter is likely to indicate a shoulder at risk of becoming painful. Both remain a problem for the successful rehabilitation of individuals post CVA.

Objectives

The objective of this *Best Practice* Information Sheet is to present the best available evidence related to the prevention and management of shoulder pain in the patient with hemiplegia.

A number of interventions have been suggested for the management of the person with shoulder pain secondary to hemiplegia. The following is a brief description of the diversity of these applications, followed by a synopsis of the systematic review results.

Prevention Interventions

Four studies looked specifically at prevention of shoulder pain through the use of shoulder positioning, strapping and slings. The literature search also identified two randomised controlled trials (RCT's) that evaluated the use of exercise and included pain as an outcome.

Shoulder positioning

There is some suggestion that shoulder positioning including key actions such as careful positioning, adequate support and proper handling may have some impact on pain and passive movement. One RCT evaluated the effectiveness of prolonged positioning of the affected shoulder daily, five days a week for six weeks. The protocol involved placing the affected shoulder in three different positions each for 20 minutes thereby placing different muscle groups in a lengthened range and placing the glenohumeral joint at or above 90 degrees of flexion and/or abduction. Pain slightly decreased at six weeks, although the therapy did not statistically significantly improve outcomes for pain or passive movement.

Strapping

Strapping of the shoulder and arm has also been used during the management of hemiplegia. In two studies strapping of the affected shoulder was undertaken to provide support in a similar manner to that provided by slings. A quasi-randomised controlled trial evaluated the effect of strapping individual's shoulders within 48 hours post CVA. The results demonstrated a statistically significant improvement in the amount of pain free days between the two groups in relation to the onset of shoulder pain ($p=0.01$). This compares with a RCT that examined the effect of strapping versus no strapping in patients with hemiplegia and persisting weakness in shoulder abduction.

Strapping was continued for six weeks. No significant differences were found in the reduction of shoulder pain, however the mean entry time to the second study post CVA was two weeks, and the authors observed that the lack of significant results could have been attributed to delayed recruitment.

Slings

It has been suggested that if stretching of the joint capsule can be avoided during the acute and flaccid phases of CVA recovery, most patients would develop sufficient muscular activity to maintain glenohumeral alignment. This shoulder support may be provided through the use of slings and other support devices. A number of devices have been reported in the literature however the literature search identified only one quasi-randomised controlled trial and no significant difference was found for range of motion, shoulder pain or subluxation.

Exercise

Exercise has been the subject of RCT's in both the rehabilitation setting and a home therapy program and has been suggested to have favourable outcomes for the patient with hemiplegia and shoulder pain. As an extension to conventional exercise regimes, enhanced physical therapy programs have also been advocated. This approach involves conventional physiotherapy combined with a selection of treatment techniques including Bobath exercises, EMG biofeedback, micro-computer games and goal setting.

One RCT compared enhanced therapy (ET) with conventional therapy (CT). The CT group emphasised expert hands-on treatment by the therapist, patients were not routinely instructed to exercise between sessions and active movement was not encouraged until abnormal muscle tone was well controlled. The ET group firstly received enhanced therapy to the arm and secondly, behavioural methods were used to encourage the patient and family to be active participants in arm rehabilitation.

Enhanced physical therapy demonstrated gains in recovery with the major effect being a significant improvement in recovery in the first month ($p=0.01$). However, this was not sustained with no statistically significant difference at the six-month assessment ($p>0.2$).

Another RCT compared the effect of three exercise interventions on patients with hemiplegia and shoulder pain using a quasi-randomisation technique. The interventions were based on passive range of motion exercises to the affected arm including range of motion therapy (ROMT), an overhead pulley (OP) exercise, and a skateboard exercise (SB) (described as tracing a figure of eight pattern on a table with a wheeled implement). Each patient received the prescribed exercise daily for 5 days per week for a period of 3 months.

The incidence of pain was significantly greater in the OP group compared with the ROMT group ($p<0.018$), but not between the SB group and ROMT group ($p<1.0$). There was no clear data comparing each intervention with range of movement achievable with or without pain. The suggestion was however, that ROM in the shoulder was significantly reduced in patients who developed shoulder pain ($p<0.01$) and subluxation played no conclusive role in the incidence of pain ($p=0.62$).

Treatment Interventions

Three studies looked specifically at prevention of shoulder pain through the use of biofeedback and intra-articular injections. The literature search also identified one RCT that evaluated the use of exercise and included pain as an outcome.

Biofeedback

Electromyogram (EMG) biofeedback has been used during rehabilitation of patients with hemiplegia. It is suggested that EMG biofeedback reduces spasticity and so promotes relaxation, reduced pain and increased range of movement at the shoulder. A randomised crossover study evaluated the effectiveness of EMG feedback as a form of treatment, in conjunction with relaxation techniques. Neither treatment was significantly more effective than the other. However, both groups showed that EMG feedback may be effective in the treatment of shoulder pain in the patient with hemiplegia as there were significant decreases in pain (Table 1).

The results should be viewed with caution as the study lacked rigorous control for potential confounding factors, such as inability to determine whether the benefit was achieved by EMG or relaxation.

Intra-articular triamcinolone injections

Patients with hemiplegic shoulder pain have been treated with intra-articular steroid injections and there has been some suggestions that pharmacotherapeutic interventions such as intra-articular Triamcinolone Acetonide reduce pain and increase passive movement. A time series study involving seven patients reported a positive combined effect on pain ($p=0.025$),

Table 1

Reduction in pain for hemiplegic patients receiving biofeedback and relaxation techniques

Group	Week 1	Week 2	Week 3	p
Biofeedback/ Relaxation	20.4(15.5)*	14.8(12.91)*	N/A	0.018
Relaxation /Biofeedback	19.2(13.9)*	13.3(11.6)*	9.9(11.21)*	0.004/0.013 Wk1+2/Wk2+3

Mean (SD) score for The McGill Pain Questionnaire (0-45)

with highly significant effect found in five of the seven patients ($p<0.0005$), although the remaining two patients showed no statistically significant effect. Analysis of the combined effect on ROM did not reveal any statistically significant differences ($p=0.13$); however, the follow up was short and the sample size small thus the study was underpowered.

Contradictory results were found in a multicenter RCT where three corticosteroid injections were compared with a placebo in 37 patients. Two patients in the corticosteroid group did not receive the third injection, but still completed follow-up. Two patients dropped out of the placebo group; one after receiving two injections and one after receiving three. No statistically significant effects were found between groups for pain or arm function. In both studies there were reports of frequent side effects (5/7 and 25/37 respectively).

Exercise

There was one RCT that included patients ranging from three weeks to nine and a half years post CVA. All patients in the study continued to receive their general physiotherapy, although treatment directed specifically toward the shoulder was withheld for the four-week period of the study. This RCT explored the use of cryotherapy (application of ice towels to the shoulder joint for a period of ten minutes pre exercise) and the Bobath exercise technique. The Bobath technique was reported to result in a statistically significant reduction in frequency of pain occurrence compared to the cryotherapy method ($p<0.05$), regardless of the degree of subluxation.

Botulinum toxin therapy

There has been some research undertaken on Botulinum toxin therapy. Intramuscular injections of Botulinum toxin are usually placed in muscles of the arm to relieve spasticity and pain. It has been suggested that this therapy may be useful for patients with spasticity due to CVA. There are a number of trials that have been conducted, although the majority refer to the effect on upper-limb pain and not specifically shoulder pain. Only one study made a brief reference to shoulder pain and stated that it had improved for six out of nine patients. This intervention requires further research.

Prevention and Treatment Interventions

A systematic review on electrical stimulation (ES) for preventing and treating post CVA shoulder pain was identified through the literature search. As the review investigated both prevention and treatment it has been reported seperately.

The use of electrical stimulation is suggested to have an analgesic effect through inducing contraction of the flaccid shoulder muscles and therefore preventing or treating subluxation. The systematic review summarised the findings from four RCTs involving a total of 170 people. Of these studies, one evaluated functional electrical stimulation (FES), two evaluated transcutaneous electrical nerve stimulation (TENS) and the fourth evaluated an electrical stimulation that was neither TENS nor FES. A combined statistically significant effect was reported for pain-free passive humeral lateral rotation ($p<0.02$) and reduction in the severity of subluxation ($p<0.00003$). There was no overall improvement in upper-limb function detected, but two of the three studies included in the meta-analysis demonstrated a motor score increase.

The authors suggested that caution is needed in interpreting these results due to the small and unequal number of participants in the trial arms. There was no improvement in upper-limb spasticity, and no negative effects as a consequence of ES.

Normal shoulder[3]

Shoulder subluxation[3]

Recommendations for Research

It should be noted that many of the studies included in the review had a small number of participants, short follow-up periods, evaluated multiple interventions and used diverse lengths of time post CVA. All or some of these issues may have impacted on the results of studies and this highlights the need for further research to fully evaluate the interventions for shoulder pain in the hemiplegic patient.

Many of the studies on CVA research also encounter difficulties when measuring outcomes. It has been found that many patients after CVA are unable to successfully complete self-report measurement scales, including visual analogue scales. It is possible that other more subjective measures may be used. It may also be difficult to establish specific definitions of complex health-care interventions for patients undergoing rehabilitation post CVA. Some of the problems identified in a systematic review on CVA rehabilitation include:

- differing definitions of the health-care problem may affect interpretation of the results (e.g. terminology)
- interventions with no single definition may be practiced in a variety of ways throughout the world
- large ranges of outcomes have been used in rehabilitation research, many of which are not standardised.

In concluding this review it is recommended that further research be initiated into the issues of shoulder pain and hemiplegia.

Recommendations for Practice

These recommendations are based on statistically significant findings found within the review. There is a need for further trials to strengthen these findings as the recommendations are based on single studies often with a limited number of participants.

Prevention interventions

- Shoulder strapping within 48 hours post CVA may help delay the onset of shoulder pain. Level III.[1]
- There is insufficient evidence on the effectiveness of slings when used for shoulder pain and subluxation. Level III.[1]

Treatment interventions

- EMG biofeedback, when used in conjunction with relaxation techniques may be effective in relieving shoulder pain. Level II
- The effectiveness of intra-articular Triamcinolone Acetonide injections was unclear and is not recommended due to the high incidence of reported side effects. Level II
- The frequency of pain occurrence is significantly reduced when using the Bobath technique compared to the cryotherapy method. Level II

Prevention and treatment

- Functional electrical stimulation can be used to improve humeral lateral rotation and reduce glenohumeral subluxation. Level I

Implications for practice

- Exercise techniques should not increase patient pain or cause pain. Level IV
- Exercise techniques used should not be dependent on whether the patient has subluxation or not. Level IV

References

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3. Shoulder Dislocation X-ray photographs used with the kind permission of EMEDx Corporation www.edmex.com

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In addition this *Best Practice* Information Sheet has been peer reviewed by experts nominated by JBI collaborating centres.