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Shoulder Pain in Stroke Patients and Its Effects on Rehabilitation

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The purpose of this study was to examine whether prompt diagnosis and management of shoulder pain is beneficial in decreasing pain and increasing range of motion and functional recovery. Among 116 stroke patients receiving outpatient rehabilitation, 48 had shoulder pain. Twenty-eight of the patients with shoulder pain received occupational therapy and physiatric management. Five of the 28 patients had specific diagnoses. Etiology of the pain in the remaining 23 patients (Group 1) was not known, and these patients were treated with nonsteroidal anti-inflammatory drugs (NSAIDs). The remaining 20 (Group 2) received only occupational therapy and were used as the control group. Pain relief, range of motion (ROM) in flexion, and abduction and functional recovery were compared in the two groups. Results show that a significantly higher percentage of Group 1 was found to have pain relief; 91% versus 15% with $p < 0.00001$ for the difference. A significant number of patients improved ROM for flexion and abduction in Group 1 versus Group 2 ($p < 0.006$ and $p < 0.055$ for the difference for flexion and abduction, respectively). Functional recovery was highly significant for Group 1, 100% compared to 55% for Group 2, with $p < 0.0001$ for the difference. These results emphasize the importance of management of shoulder pain with NSAIDs along with ROM exercises for successful rehabilitation of hemiplegic patients. **Key Words:** Hemiplegia—Shoulder pain—Range of motion.

Shoulder pain is the most common complication of hemiplegia. This retrospective study evaluated the effect of treatment on shoulder pain. The measures used for the evaluation were increase in function, relief of pain, and increase in range of motion (ROM) (flexion and abduction). This study shows that there is no definable cause for the pain in a majority of the treated patients. However, treatment does positively influence rehabilitation by relieving pain and increasing ROM and function.

Pain may be the result of the neurological deficit itself (1), or it may arise from non-neurological conditions. Patients frequently have glenohumeral subluxation, severe paralysis of the extremity, and edema of the wrist and hand. The pain in hemiplegia has been attributed to subluxation, spasticity, reflex sympathetic dystrophy, rotator cuff tendinitis, brachial plexus neuritis, improper handling of the paralyzed arm, and improper exercises. However, a definite etiology cannot be identified in many cases (see Table 1). Patients complain of pain when the arm is in a dependent position and when passive ROM is attempted. Pain may be present at rest and aggravated by ROM. Braun et al. (2) showed that patients who experience pain while moving the joint remain immobile and those who have pain at rest withdraw from active rehabilitation programs. These two observations are common in the rehabilitation setting of stroke patients.

In addition to the pain and suffering, other possible

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Table 1. *Causes of hemiplegic shoulder pain*

Subluxation
Spasticity
Shoulder–hand syndrome (reflex sympathetic dystrophy)
Rotator cuff tendinitis
Brachial plexus neuritis
Improper handling of the paralyzed arm
Improper exercises

Table 2. *Effects of shoulder pain in hemiplegia*

Pain and suffering
Loss of range of motion
Delay in functional recovery (dependence in self-care and mobility)
Decreased use of the arm
Poor participation in rehabilitation
Frustration and depression
Lack of interest in social activities

effects of shoulder pain are loss of ROM, delay in functional recovery, decreased use of the arm, poor participation in rehabilitation, lack of interest in social activities, and frustration and depression (see Table 2).

Methods and Materials

Medical records of 116 patients with stroke were reviewed after completion of their outpatient rehabilitation. These 116 patients were referred to a free-standing, not-for-profit outpatient facility by local rehabilitation units, local physicians, public health nurses, and occasionally by families. The patients were noted to have undergone various levels of rehabilitation, e.g., inpatient, outpatient, and in-home therapies in some cases prior to admission to the program. In a 3-year period, between 1986 and 1989, 48 of the 116 stroke patients were noted to have experienced shoulder pain. The data were collected from the physiatric evaluations and occupational therapists' evaluation and progress notes. The occupational therapist recommended all 48 patients be evaluated by the physiatrist. The reason for the referral was that the patients were unable to tolerate ROM due to shoulder pain and were missing therapies due to fear of pain from ROM. The occupational therapy notes included reports of shoulder pain either during flexion, abduction, and rotations or during end ROM. Active and passive movements were described with measurement for flexion and abduction. Rotations were mentioned but not measured consistently in all records. Also described was the patient's ability to use the affected arm either actively (if motor function present) or as an assist to the unaffected arm. Only 28 of the 48 patients referred were examined and managed by the physiatrist. These patients were classified as Group 1.

Table 3. *Causes of shoulder pain in this study*

Subdeltoid bursitis	1
Spasticity	1
Fracture of humerus	1
Shoulder–hand syndrome	2
No identifiable causes	23

The remaining 20 patients' records indicated that they were also advised to seek physiatric evaluation for shoulder pain but were unable to do so. The reasons for the failure were described as patient or family's inability to follow the recommendation and/or lack of transportation. This group of patients was considered as the control group and were referred to as Group 2. The physiatrist's evaluation described patients experiencing pain in the hemiplegic side in all the patients, but in one of them there was bilateral shoulder pain from pre-existing bursitis. They complained of pain when the arm was in a dependent position. Pain was present at rest in some patients, but it was aggravated by ROM. In some patients, pain interfered with sleep, especially while sleeping on the affected side. The mean duration between the onset of the stroke and the development of shoulder pain was 2.1 months (range, 0.75–9 months). The patients' motor recovery was described as ranging between no volitional movements to isolation to grades 1–3 proximally at the shoulder and elbow, with very few patients showing wrist or hand muscle recovery. The evaluation included shoulder examination as described by Hawkins and Hobeika (3) with specific notation made for the presence or absence of subluxation, motor recovery, presence of spasticity, and swelling or trophic changes in the upper extremity.

Subluxation was present in 13 of the treated group and in 11 of the control group. Subdeltoid bursitis, spasticity, fracture humerus from a fall, and shoulder–hand syndrome were found to be the causes for the shoulder pain in 5 of the 28 in the treated group. In the remaining 23, no causes were identified (see Table 3). This group of 23 is described in Table 4 as Group 1 and the untreated or control group as Group 2. It was not clear if any of Group 2 patients had a known cause of shoulder pain as in Group 1. The demographics of the

Table 4. *Patient characteristics*

	Group 1 (n = 23)	Group 2 (n = 20)
Age (years)		
Mean	67	63
Range	45–82	38–84
Sex		
Male	15	12
Female	8	8
Side of hemiplegia		
Left	13	8
Right	10	12
Inpatient rehabilitation		
Yes	13	15
No	10	5
Duration between CVA and admission to outpatient program (days)		
Mean	135	259
Range	12–533	43–1,060
Length of stay in the program (months)		
Mean	4	4
Range	1.5–8.5	1.5–9

two groups are described in Table 4. The average age of Group 1 was 67 years (range, 45–82), and the mean age of Group 2 was 63 years (range, 38–84). Thirteen of Group 1 and 15 of Group 2 had undergone inpatient rehabilitation. The mean duration between the onset of stroke and admission to the outpatient therapy was 135 days for Group 1 and 259 days for Group 2. There were five patients in Group 2 who were admitted to the program more than a year after their stroke (range, 410–1,060 days). Their inclusion brought the average to 259 days. There were only two patients in Group 1 who were admitted a year poststroke (406 and 533 days). There were 13 left hemiplegics and 10 right hemiplegics in Group 1 and eight left hemiplegics and 12 right hemiplegics in Group 2.

Upon evaluation, the five patients diagnosed with the conditions in Table 3 were treated with 200 mg sulindac b.i.d. and ultrasound for bursitis, diazepam for spasticity, immobilization for 2 weeks and gentle ROM for fractured humerus, and oral steroids for the shoulder–hand syndrome. The 23 patients who had no discernible etiology were treated with nonsteroidal anti-inflammatory drugs (NSAIDs) (ibuprofen, 400–800 mg t.i.d., and sulindac, 150 mg b.i.d.) with instructions to take the medication 30–60 min prior to occupational therapy. Ten of these patients were treated with ultrasound to the shoulder three times a week for 2 weeks prior to ROM exercises. These patients were all treated by an occupational therapist with ROM and appropriate active assistive or strengthening exercises in addition to activities of daily living (ADL) training. Ultrasound was not given to all the patients due to their inability to attend therapy four or five times a week or due to the presence of contraindications and/or intolerance to heat.

The 20 patients in Group 2 received only occupational therapy with ROM, active assistive and strengthening exercises, and ADL training. Since the second group was not evaluated by the physiatrist, no medications were prescribed. One of these 20 patients received ultrasound at the prescription of his private internist. Patients of both groups attended the therapy sessions either two or three times a week on an average of 4 months (range, 1.5–9.0). After the initial evaluation by the therapist, patients and families were given instructions for a home exercise program consisting of ROM and active assistive and/or strengthening exercises. Statistical analyses of the results were done through Student's t test. Level of significance was set at $p < 0.05$. Patient data are tabulated in Table 4.

Results

Among the 48 patients with hemiplegic shoulder pain, 28 were evaluated and treated. Twenty-three of the 28 (Group 1) had no identifiable causes for the pain and were treated with NSAIDs. The remaining five had known causes for which specific treatment

Table 5. *Response of the groups in percentages*

	Group 1 (n = 23)	Group 2 (n = 20)	p Value for the differences
Pain relief	91	15	<0.00001
Increase in ROM			
Flexion	78	40	<0.006
Abduction	74	50	<0.055
Increase in function	100	55	<0.0001

was rendered. The remaining 20 (Group 2) formed the control for comparisons.

The following results were obtained by comparing the 23 patients of Group 1 with the control group (see Tables 5 and 6). Pain relief in these patients was significant: 91% of Group 1 (n = 23) versus 15% (n = 20) in Group 2 ($p < 0.00001$ for the difference). ROM for flexion improved in 78% of Group 1 in contrast to 40% in Group 2 ($p < 0.006$ for the difference). Mean increases in the ROM were 28.4° and 13.3° for these groups, respectively ($p < 0.03$ for the difference). Abduction also improved in the 23 patients, 74% of Group 1 as compared to 50% for the control group ($p < 0.55$ for the difference). Average increase in abduction was 29.9° and 18.3° for these groups ($p < 0.125$ for the difference). As can be seen, both flexion and abduction increased for a greater number of patients in Group 1 and Group 2. However, the difference in the average increase for Group 1 is much more significant for flexion than for abduction. The status of ROM for flexion and abduction for the two groups, before and after treatment, is illustrated in Figs. 1 and 2.

Average increases for flexion and abduction for the entire treated group of 28 were found to be similar to those of the 23 patients. As described in the above paragraph, the five patients in Group 1 with definite causes of shoulder pain also improved their ROM.

Finally, functional recovery was remarkably significant for Group 1 with 100% of patients improving their ability to use the affected extremity as opposed to 55% in Group 2 ($p < 0.0001$ for the difference). The results in percentages are summarized for the two groups in Fig. 3.

Table 6. *Mean increase in ROM of the painful shoulder*

	Group 1 (n = 23)	Group 2 (n = 20)	Difference
Flexion	28.4°	13.3°	15.1°
	(SD 28.9)	(SD 24.4)	(SD 26.6)
	($p < 0.0005$)	($p < 0.013$)	($p < 0.03$)
Abduction	29.9°	18.3°	11.6°
	(SD 33)	(SD 28.3)	(SD 30.9)
	($p < 0.0005$)	($p < 0.005$)	($p < 0.125$)

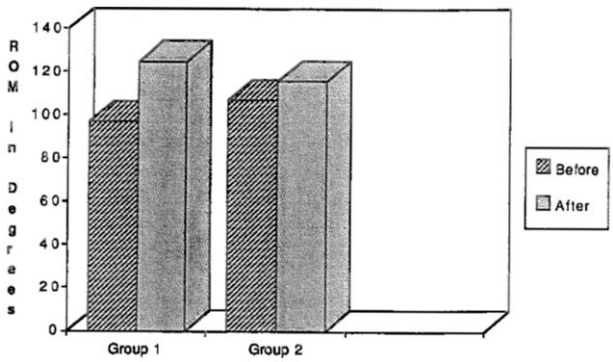

Figure 1. *Flexion before and after treatment.*

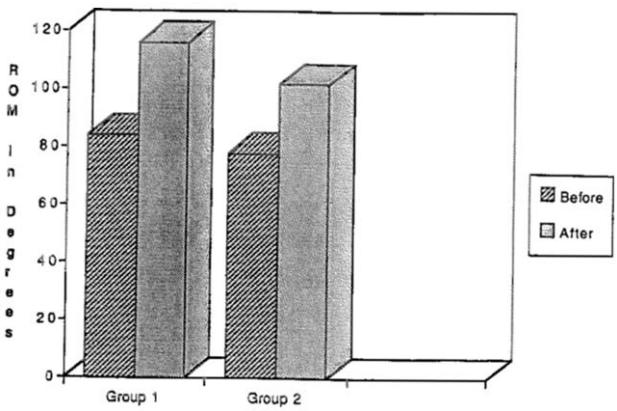

Figure 2. *Abduction before and after treatment.*

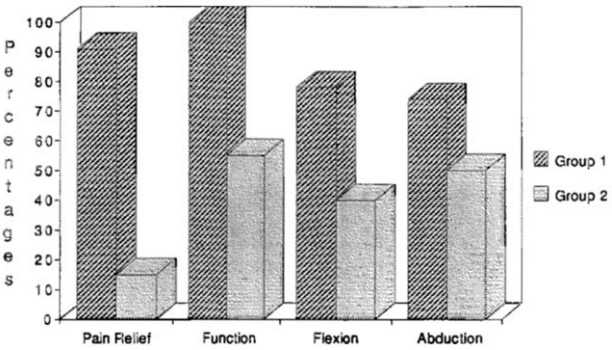

Figure 3. *Response to treatment.*

Discussion

Etiology of shoulder pain in hemiplegia is unclear and very often cannot be diagnosed. Shoulder pain, a frequent complication of hemiplegia, can result in more disability than the stroke itself. Pain can develop as early as 2 weeks' poststroke, but the usual occurrence is noted to be 2–3 months after the onset of stroke. The incidence of shoulder pain is reported (4,5) to be as high as 72%. Van Ouwenaller et al. (4) claimed spasticity as the primary cause of pain. Bohannon et al. (5) looked at age, time since onset of stroke, external rotation of the shoulder, spasticity, and weakness. They concluded that shoulder pain could be a manifestation of adhesive capsulitis. Several studies have attempted to ascertain the etiology of pain, but, to date, no specific cause has been found to be responsible for the pain. Exaggeration of previous bursitis in stroke patients was described earlier (4) as seen in one of the patients. One study (6) declared that subluxation does not play an important role in the production of pain. Side of hemiplegia (7), hemi-neglect (8), and loss of sensation were all studied for possible correlations. The role of exercise (in rehabilitation settings) in the production of shoulder pain was also tested (9). This study alluded to the use of overhead pulley exercises as a risk for developing the pain. Most recently, Joynt (10) suggested that the subacromial area of the shoulder may be the site of pain production, but he has not mentioned any pathology. Reflex sympathetic dystrophy (RSD) was reported in 12.5% of hemiplegics by Davis et al. (11) and in 25% by Tepperman et al. (12). Earlier studies, for example in Steinbrocker (13) on shoulder–hand syndrome, show an incidence of RSD of 8.6% in stroke patients. A much lower incidence of 4% was found in an analysis of 125 cases by Subbarao and Stillwell (14).

In this study, 7% of the 23 patients proved to have reflex sympathetic dystrophy by the presence of swelling of the wrist and the hand, vasomotor changes, pain on ROM of the shoulder, wrist, metacarpal–phalangeal, and interphalangeal joints with sparing of the elbow joint. These cases had three-phase bone scans demonstrating localized uptake in the affected shoulder joints, and the patients promptly responded to oral steroid treatment. Werner et al. (15) also stated that the first choice of treatment for RSD is oral corticosteroids in addition to physical or occupational therapy. In a study of 30 patients by Inaba et al. (16), treatment by ultrasound was not found to have any significant effect on the relief of shoulder pain. The present study did not attempt to isolate the effect of ultrasound on the 10 patients who received it.

The current study demonstrates that the use of NSAIDs relieves pain significantly to enable patient participation in rehabilitation. Two in the treated group were 1-year poststroke and had shoulder pain that also responded to NSAIDs. In contrast, the control group had five patients who were 1-year poststroke when they entered the program, and their shoulder pain was left untreated. The response by the two patients in Group 1 emphasizes the importance of the treatment. Stroke patients with associated hypertension and renal disease may pose a concern for administering the NSAIDs. Additionally, some of these patients also received aspirin compounds for prophylactic anticoagulation for prevention of recurrent strokes. Concurrent use of aspirin compounds and NSAIDs is generally not recommended. However, no adverse effects were noted in the current study population.

ROM was monitored closely for flexion and abduction. These two movements are thought to be most useful for using the affected arm as a stabilizer and also for ADLs. Inaba et al. (16) reported that external rotation is the most painful and limited movement. External rotation has only limited usefulness for functional activities, and patients display limited tolerance for this movement. External rotation was not monitored in these patients and the reason was not explained in the records. The two groups were similar in every respect except the control group had a greater interval between the onset of the stroke and admission to the program. The onset of shoulder pain was 2.1 months on an average poststroke. The patients naturally guarded the shoulder because it was painful to move and did not tolerate efforts to increase ROM by the therapist. Had these patients been evaluated and treated, perhaps an improvement could have been expected.

Treatment definitely improved the flexion and abduction needed by the patients for using the affected arms. Patients who were not able to obtain evaluation

and treatment were reported to have missed therapies, had depression (in two cases), and had minimal participation as a result of the pain. Lack of participation in rehabilitation by the control group was reflected in the ROM and functional recovery.

Conclusions

Since etiology is not totally understood, prevention of shoulder pain can be a difficult task in hemiplegia. Shoulder pain in hemiplegia can develop as early as 2 weeks or as late as 1 year from the onset of stroke, but most often it occurs in 2–3 months. The present study shows that regardless of the onset and the duration of the pain, patients responded to NSAIDs with progress in rehabilitation. Only a few patients had specific causes of pain and no definite etiology was found in most of these cases. However, all patients responded to treatment with relief of pain and experienced improved ROM and use of the affected arm. Prospective studies are needed to understand this difficult but treatable condition to prevent morbidity and associated sequelae of shoulder pain in hemiplegic patients.

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