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RESEARCH

THE COMPARISON OF THE EFFECTS OF THE COMBINATION OF PHYSICAL THERAPY MODALITIES AND LOCAL CORTICOSTEROID THERAPY AND ALONE PHYSICAL THERAPY IN THE PATIENTS WITH HEMIPLEGIC SHOULDER PAIN

ABSTRACT

Introduction: The present study aimed to explore whether the combination of physical therapy modalities and local corticosteroid therapy is superior to singly applied physical therapy modalities in patients with hemiplegic shoulder pain (HSP).

Materials and Method: In this randomized comparative study, 30 patients who had shoulder pain due to hemiplegia were randomly divided into two groups. The first group consists of 15 subjects (injection group) who received conventional physical therapy modalities (hotpack, ultrasound, TENS), exercised for 15 sessions and received local steroid injection into the shoulder once the study began. The second group (control group) received only conventional physical therapy modalities and exercised. Patients were evaluated three times: at treatment baseline, at the first week, and at the 7th post-treatment week. Evaluations were performed by using a visual analogue scale, range of motion measurements, functional independence measure (FIM), Brunnstrom upper extremity stage, and modified Ashworth scale.

Results: Statistically significant ($p<0.05$) improvement was observed in visual analogue scale, range of motion measurements, functional and daily activities, and Brunnstrom motor development stage, while a significant decrease was detected in spasticity according to modified Ashworth scale, in both groups after the treatment. However, comparison of groups did not reveal any statistically significant difference ($p>0.05$).

Conclusion: Our results show that the combination of local corticosteroid and physical therapy modalities is not superior to singly applied physical therapy modalities.

Key Words: Hemiplegia; Shoulder Pain; Physical Therapy Modalities.

ARAŞTIRMA

HEMİPLEJİK OMUZ AĞRISI TEDAVİSİNDE LOKAL KORTİKOSTEROİD ENJEKSİYONU VE FİZİK TEDAVİ MODALİTELERİ KOMBİNASYONUNUN TEK BAŞINA FİZİK TEDAVİ MODALİTELERİ ETKİNLİĞİ ILE KARŞILAŞTIRILMASI

ÖZ

Giriş: Bu çalışma, hemiplejik omuz ağrılı hastalarda lokal kortikosteroid enjeksiyonu ve fizik tedavi modaliteleri kombinasyonunun tek başına fizik tedavi modaliteleri etkinliğine üstün olup olmadığını araştırmak amacıyla yapıldı.

Gereç ve Yöntem: Bu çalışmaya serebrovasküler bir olay sonrası hemipleji geçiren ve hemiplejiye bağlı omuz ağrısı gelişen 30 hasta alındı. Hastalar rastgele iki gruba ayrıldı. Birinci gruba (enjeksiyon grubu) konvansiyonel fizik tedavi modaliteleri (hotpack, ultrason, TENS), 15 seans egzersiz tedavisi ve çalışmanın başlangıcında omuza lokal steroid enjeksiyonu yapılan 15 kişi alındı. İkinci gruba (kontrol grubu) sadece konvansiyonel fizik tedavi modaliteleri ve egzersiz tedavisi uygulandı. Hastalar tedavi öncesi, tedavi programının birinci haftası ve tedavinin bitiminden sonraki 4. haftada olmak üzere toplam üç kez değerlendirildi. Değerlendirmelerde vizüel analog skala, eklem hareket açıklığı ölçümleri, fonksiyonel bağımsızlık ölçeği, Brunnstrom üst ekstremite evrelemesi ve modifiye Ashworth skalası kullanılarak yapıldı.

Bulgular: Tedavi sonrası her iki grupta vizüel analog skala ve eklem hareket açıklığı, ölçümlerinde, fonksiyonel ve günlük yaşam aktivitelerinde, Brunnstrom motor gelişim değerlendirilmesinde istatistiksel olarak anlamlı iyileşemeler ve modifiye Ashworth skalasına göre spastisitede azalmalar görüldü. Ancak gruplar karşılaştırıldığında istatistiksel olarak anlamlı bir farklılık yoktu ($p>0.05$).

Sonuç: Sonuç olarak lokal kortikosteroid ve fizik tedavi modaliteleri kombinasyonunun sadece fizik tedavi modalitelerine üstünlüğü görülmedi.

Anahtar Sözcükler: Hemipleji; Omuz Ağrısı; Fizik Tedavi Modaliteleri.

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Introduction

The majority of patients who have experienced hemiplegia following stroke develop upper extremity complications. Hemiplegic shoulder pain (HSP) occurs in 16-85% of the patients as a consequence of upper extremity complications (1,2). Despite the high prevalence of HSP patients, its etiology and treatment remain debatable.

The present study aimed to explore whether the combination of physical therapy modalities and local corticosteroid therapy is superior to singly applied physical therapy modalities in the patients with HSP.

Materials and Method

This randomized controlled trial involved of 30 patients affected with HSP (male 11, female 19). 40 hemiplegic patients were invited to the study and all patients signed a consent letter; however 10 patients were excluded from the study because 8 had severe shoulder subluxation and 2 had been diagnosed with complex regional pain syndrome. We followed all the cases until end of the study period. We made sure that all of them attended all the sessions. There was no dropout for any reason. Patients participating in the study were informed about aim and duration of the study, mode of implementation, potential adverse events and problems that were likely to during the study. Approval of the ethical committee was obtained for the study. Inclusion criteria were: aged between 20 and 75 years, presence of past ischemic or hemorrhagic stroke, at least 8 weeks' time after the stroke attack, and detecting impingement syndrome or adhesive capsulitis. Exclusion criteria were: unconsciousness, bilateral hemiplegia or history of stroke, history of shoulder trauma or shoulder surgery, physical therapy for or steroid injection into shoulder of the involved side in the last 6 months' time, presence of severe shoulder subluxation (grade 3) or dislocation (grade 4) or heterotopic ossification on the shoulder graph, concomitant burning type of shoulder pain radiating to hand and arm, being diagnosed with complex regional pain syndrome (CRPS), presence of hand edema, intra-articular or peri-articular infection or atrophy, and inflammatory arthritis around the shoulder joint. The patients were admitted to the clinic and included in the rehabilitation program. Assessment forms were used to record patients' age, gender, occupation, marital status, education level, dominant hand, hemiplegic side, systemic disease, etiology of lesion, duration of disease and HSP. Medical history, routine biochemical analyses, AP and axillary shoulder graphs were obtained from patients, who were admitted to our clinic with HSP and had had a stroke, in order to differentiate other diseases which could cause the HSP. They underwent detailed physical examination. Tenderness of supraspinatus and greater tuberosity, acromioclavicular joint and biceps tendon, subacromial crepitation, scarring, atrophy, and deformities were evaluated by active and passive range of joint motion (ROM), Neer's test, Hawkins' test, horizontal adduction test, painful arc test, drop arm test, Yergason's test, Speed test, and Jobe's test (supraspinatus test), performed particularly after the evaluation of muscle strength and spasticity. All patients with spasticity were using oral antispasmodic drugs. The Subacromial impingement injection test was performed in patients with positive impingement tests by injecting 10 ml of 1% lidocaine and epinephrine into the subacromial joint space. A subacromial impingement syndrome diagnosis was verified for patients who experienced substantial relief in pain, and whose range of joint motion improved with this treatment. Patients with passive ROM limitation were evaluated according to the Rizk criteria (3) and the diagnosis of adhesive capsulitis was made based on these criteria. The patients were evaluated three times: before treatment (T1), at the first week of therapy program (T2) and at the 7th week after beginning therapy (T3). Clinical evaluation included degree of range of motion (ROM) measurements of shoulder joint, resting-activity-night visual analog scale (VAS) scores (for pain), motor-manual muscle test for the evaluation of muscle strength, Brunnstrom upper extremity staging for the evaluation of motor development, and modified Ashworth scale (MAS) (4) for the evaluation of tonus. Functional evaluation was done using a functional independence measurement (FIM) (5).

Randomization and Therapy Protocol

The patients were randomly divided into injection (8 females and 7 males) and control (9 females and 6 males) groups. Group 1 received local steroid injection, physical therapy modalities [hotpack (HP), ultrasound (US), transcutaneous electrical nerve stimulation (TENS)] and exercise, whereas Group 2 received only physical therapy modalities and exercise therapy. A physician was assigned to give the electrotherapy. Rehabilitation programs of patients were performed by the same physician for each group for a total of 15 sessions: 5 days a week for 3 weeks. A single local steroid was injected 2-3 days before the beginning of therapy. Patients were not allowed to exercise for 2-3 days. One milliliter of triamcinolone acetonide (Kenacort-A 40mg/ml) was used as local

corticosteroid and 5 ml of lidocaine HCl + epinephrine (jetocaine 2 ml vial) was used as local anesthetic agent. In the injection group, the drug was injected into the subacromial region via posterolateral approach in three patients, who were diagnosed with subacromial impingement syndrome based on subacromial impingement clinical tests and injection test, whereas the drug was injected via posterior approach in 12 patients diagnosed with adhesive capsulitis based on Rizk criteria (3). A single injection was given on the last day of the first week and patients were prevented from exercise for two days. Patients in both groups underwent HP for 20 minutes, continuous and circular US with 0.5 watt/cm^2 at 1 MHz frequency for 10 minutes, and 4-electrode transarticular TENS by conventional method for 30 minutes, each for 5 days a week. Each day, a passive and active range of motion exercise program was performed following physical therapy modalities.

Statistical Analysis

The SPSS for Windows (Version 11.5) computer program was used for statistical evaluation. Pre-treatment and subsequent follow-up values of each evaluation parameter were recorded, and inter-group and intra-group outcomes were compared. Student-t test and Chi square analysis were used for these comparisons. Two-way analysis of variance was used to evaluate group-time interaction. Results with a *p* value smaller than 0.05 were considered significant.

Results

Between the groups, there were no statistically significant differences in terms of age, gender, disease duration and duration of HSP (p>0.05) (Table 1). Likewise, no differences were found between the groups in terms of dominant side, paralytic side and etiologies (p>0.05). According to the goniometric measurements of the shoulder, there were no differences between the groups in terms of flexion, abduction and internal rotation, but external rotation was significantly different between groups (p<0.05) (Table 1).

In the injection group, a statistically significant increment was observed in all directions of shoulder goniometric measurements performed during T1-T2, T2-T3 and T1-T3 periods (p<0.05) (Table 2).

In the control group, significant ROM increment was observed only during flexion in the T1-T2 period, whereas statistically significant increments were determined for all directions during shoulder goniometric measurements in T1-T3 and T2-T3 periods (p<0.05).

Table 1— Demographic and Clinical Characteristics of the Study Subjects

Variable	Control Group	Injection Group	p value
Age (years)	62.3±7.5	62.0±8.9	>0.05
Gender (M/F)	6/9	7/8	>0.05
Disease duration (month)	8.1±2.7	7.1±2.4	>0.05
Shoulder pain duration (month)	5.1	4.7	>0.05
Shoulder flexion	114.6±15.1	105.6±17.0	>0.05
Abduction	107.6±15.5	101.3±16.1	>0.05
Internal rotation	65.3±10.9	64.0±12.5	>0.05
External rotation	62.3±10.1	50.6±13.2	≥0.05
Resting VAS	4.9±1.6	5.2±1.4	>0.05
Activity VAS	7.7±1.1	7.5±1.1	>0.05

In the injection group, statistically significant reductions were determined in resting, activity and night VAS values in T1-T2, T1-T3 and T2-T3 periods (p<0.05) (Table 2).

In the control group, statistically significant reductions were determined in resting, activity and night VAS values in T1-T2, T1-T3 and T2-T3 periods (p<0.05)

There was a significant difference between the improvement in pretreatment versus post-treatment FIM scores of the injection group and control group (p<0.05). No statistically significant difference was detected when the groups were compared in terms of post-treatment FIM values (p>0.05) (Table 2).

There were significantly important improvements between pre-treatment and post-treatment upper extremity Brunnstrom stages in both groups. No statistically significant difference was detected between groups in terms of post-treatment Brunnstrom stages (p<0.05) (Table 3).

The tonus decreased significantly between pre-treatment and post-treatment in both groups (p<0.05). Post-treatment comparison of both groups revealed no significant difference between tonus evaluations performed according to the Modified Ashworth Scale (p>0.05).

Finally, patient data was measured in both groups at three different times. As well as the main effect of patient group and time frame, patient group-time interaction was included in the linear model to compare response to therapy over time among groups. With regard to patient group-time interaction, intergroup comparison revealed no statistically significant difference between the injection and control groups for any of the parameters over time.

Table 2— Changes of Shoulder ROM Measurements, VAS and FIM After Treatment, in the Injection and Control Groups

	T1-T2	t	T1-T3	t	T2-T3	t
Flexion						
IG	8.3±5.6	5.8***	28.7±11.6	9.6***	20.3±10.1	7.8***
CG	5.0±5.3	3.6**	16.6±8.9	7.1***	11.6±7.4	6.0***
Abduction						
IG	7.7±6.	4.8***	26.0±10.6	9.5***	18.3±8.8	8.1***
CG	3.6±7.4	1.9	13.0±11.9	4.2**	9.3±7.5	4.8***
Internal rotation						
IG	3.0±4.1	2.9*	8.0±7.9	3.9**	5.0±6.8	2.8*
CG	3.0±6.7	1.7	5.6±6.7	3.2**	2.6±3.2	3.2***
External rotation						
IG	6.3±4.8	5.1***	19.7±9.9	7.7***	13.3±9.2	5.6***
CG	4.6±8.9	2.0	10.3±8.1	4.9***	5.6±5.9	3.6**
Resting VAS						
IG	0.6±0.5	4.6***	2.7±0.8	12.6***	2.1±0.6	13.5***
CG	0.5±0.4	4.0**	1.8±1.3	5.0***	1.3±1.2	4.0**
Activity VAS						
IG	0.9±0.8	4.5***	3.3±1.1	11.5***	2.3±1.0	8.6***
CG	0.8±0.6	5.2***	2.6±1.3	7.6***	1.8±0.9	7.4***
Night VAS						
IG	0.6±0.6	3.7**	2.3±1.2	7.3***	1.7±1.0	6.5***
CG	0.5±0.6	2.8*	2.1±1.4	5.6***	1.6±1.2	5.0***
FIM Motor						
IG	1.9±1.8	3.9**	7.1±4.6	5.9***	5.3±3.9	5.2***
CG	1.7±2.3	2.8*	6.7±5.3	4.8***	5.0±4.5	4.3**
FIM Cognitive						
IG	0.9±1.3	2.8*	5.0±4.1	4.7***	4.0±3.7	4.2**
CG	1.2±1.5	3.2**	3.7±3.6	3.9**	2.5±2.5	3.9**
FIM Total						
IG	2.8±1.8	5.9***	12.1±6.0	7.8***	9.3±6.2	5.9***
CG	2.3±2.7	3.3**	9.8±5.5	6.9***	7.5±4.7	6.1***

* p<0.05 ** p <0.01 *** p <0.001

T1: Before treatment T2: First week of therapy T3: 7th week after the beginning of the therapy

IG: Injection group CG: Control group

Discussion

Studies have shown that the level of functional independence gained as a consequence of rehabilitation programs in patients with stroke is substantially associated with motor insufficiency of the upper extremity and hand (6). In the presence of HSP, motor functions of the patient are concealed and transfer and ambulation problems may also appear with the prolonged rehabilitation period (7).

The prevalence of HSP, which unfavorably affects upper extremity rehabilitation and prolongs the rehabilitation period, has been reported over a wide range ? between 5% and 84%. Such a wide range of prevalence may result from different methods used to identify shoulder pain, and from different evaluation times. The present study aimed to explore the effect of rehabilitation with or without corticosteroid injections on shoulder function in patients with HSP. Absence of significant differences between the groups in terms of age, gender, disease duration, and time to the onset of HSP may be due to the homogeneity among study patients (1-3,6,7).

Rizk et al. conducted a study on 48 patients with adhesive capsulitis and found that pain was reduced in 2/3 of the patients with corticosteroid-lidocaine therapy, despite a lack of remarkable improvement in ROM (6). Similarity of the

Table 3— Changes in Brunnstrom Upper Extremity Stages of Both Groups After Treatment

	Brunnstrom Upper Extremity Staging	IG	CG
T1 n (%)	Stage 1	3 (20.0%)	3 (20.0%)
	Stage 2	5 (33.3%)	5 (33.3%)
	Stage 3	7 (46.7%)	7 (46.7%)
	Stage 4	–	–
	Stage 5	–	–
T2 n (%)	Stage 1	–	–
	Stage 2	4 (26.7%)	4 (26.7%)
	Stage 3	10 (66.7%)	8 (53.3%)
	Stage 4	1 (6.7%)	3 (20.0%)
	Stage 5	–	–
T3 n (%)	Stage 1	–	–
	Stage 2	1 (6.7%)	1 (6.7%)
	Stage 3	2 (13.3%)	3 (20.0%)
	Stage 4	8 (53.3%)	9 (60.0%)
	Stage 5	4 (26.7%)	2 (13.3%)

T1: Before treatment T2: First week of therapy T3: 7th week after beginning of the therapy
IG: Injection group CG: Control group

pathology in patients with HSP to those with adhesive capsulitis, and successful outcomes obtained with intra-articular corticosteroid injection in patients with extra-hemiplegic adhesive capsulitis, have indicated the advisability of intra-articular steroid for HSP. Our study showed similar results on this variable.

Snels et al. investigated the efficacy of steroid injection in HSP in a study of 37 patients. They evaluated external rotation as a single parameter in ROM measurements and found no significant difference between the injection group and the placebo group in terms of passive external rotation at the end of three weeks (8). A study by Dekker investigated the efficacy of intra-articular triamcinolone on HSP in 7 patients; shoulder ROM of patients was evaluated on the 2nd, 3rd and 4th weeks, but no significant increments were observed (9).

Ercin et al. conducted a study on 28 patients with HSP; one patient group received intra-articular 3 steroid injections with a one-week interval, whereas the other group received physical therapy. Despite significant improvement in VAS scores in both groups at the end of the study, improvement was found to be more significant in the injection group. Increment in ROM during abduction and internal rotation was significant in favor of the injection group (10). In addition, Joynt applied local anesthetic into the subacromial region in 28 patients with HSP and right afterwards determined significant improvement in pain in 14% and moderate improvement in 29% of patients (11). Further, Chae et al. analyzed 61 patients with chronic stroke and found no correlation between HSP and the Fugl-Mayer scale, Functional Independence Measure, or Arm Motor Ability test (12). In our study, we evaluated improvement in FIM scores over time and observed that this improvement was in line with a decrease in pain scores and increase in ROM.

Bourestom defended the practice of starting rehabilitation early in interdisciplinary rehabilitation centers, as it is correlated with better functional outcomes independent of the severity of stroke and baseline functional loss (13,14). Additionally, Oz et al. found pre-treatment FIM scores to be lower, but improvement in FIM to be higher, in patients who started rehabilitation early (before 40 days). Relatively less improvement was observed in late onset patients with better initial functional and motor scores, and this situation was attributed to the ceiling effect (15). In addition, Ring et al. detected the same ceiling effect, demonstrating a negative correlation between pretreatment FIM score and improvement in FIM among patients with similar CVA duration. They reported pretreatment FIM score and mean rehabilitation duration as the best predictors of functional improvement (16).

In the results of this study, although patients with high pretreatment FIM scores had relatively less elevated post-treatment FIM scores, post-treatment FIM scores were higher in these patients versus the other ones. This, similar to the literature, indicates that pretreatment FIM score is important in predicting post-rehabilitation functional improvement in patients who have had a stroke for the first time. The average duration of stroke in the participants of the present study was longer than 6 months in 80% of study subjects, and the best improvement in Brunnstrom stages and muscle strength was obtained in the patients who presented within the 6th month of stroke. Lakse conducted a study on HSP patients and controls and failed to detect significant improvement in Brunnstrom motor staging in both groups; this was attributed to long disease duration of the enrolled patients (17). Moreover, Balci et al. found a significant negative correlation between shoulder problem and improvement in upper extremity motor function (18). Likewise Wanklyn et al. (19) found motor functions to be better in hemiplegic patients with and without shoulder pain. Kizil et al. found upper extremity Brunnstrom motor improvement stages to be better in the patients without HSP (20). On the other hand, Aras

et al. (7) and Barlak et al. (21) reported that there was no difference between the patients with and without HSP in terms of Brunnstrom motor improvement stages. Gamble et al. detected that prevalence of HSP was higher within 6 months in the patients who had complete hemiplegia at the beginning (22). In their previous study, the same group reported a remarkable relationship between muscle weakness and HSP, particularly in the 6th month (23). Rajaratnam et al. evaluated 152 patients on the 2nd week of stroke, and reported more frequent HSP in patients with deltoid muscle weakness less than 3/5; they suggested that concomitance of initial muscle strength and Neer test, and painful external rotation, might be the predictor of future HSP (24). Van Ouwenaller et al. followed 219 hemiplegic patients for 11 months and reported HSP in 85% of the patients who developed spasticity and in 18% that remained flaccid (25). On the other hand, some studies have reported that there is no relationship between spasticity and HSP (5). Karatas et al. conducted a study in a group of 31 patients and similarly found no relation between increased tonus and pain (26). Kizil et al. performed a study in 38 patients, who had had a stroke in the last 18 months, and found no difference between the patients with and without HSP in terms of spasticity (20). Lakse compared corticosteroid injection and physical therapy agents in 38 HSP patients, used MAS to evaluate the tonus, and found no difference between the two groups in terms of improvement in tonus (17).

In the present study, adverse events were not observed in any of the 15 patients who received local steroid injections. Local pain and redness in the skin of the injection area lasting for 1-2 days were the most common adverse events of corticosteroid injection into the hemiplegic shoulder reported in the literature. Blood glucose change was observed in none of the diabetic patients (9). Earlier, Lakse compared local steroid injection and conventional physical therapy methods in HSP, and detected no adverse events among injection group patients (17). In the Netherlands, a survey about the use of triamcinolone injection was carried out among physiatrists and neurologists who were following up stroke patients, and the prevalence of injection as the first line treatment option was detected as 7%. The prevalence of expecting efficacy from triamcinolone was 70% among physiatrists and 47% among neurologists. The route of injection was intra-articular at a rate of 65.1% followed by peri-articular (8). Similarly in Turkey, Lakse conducted a study about the place of injection therapy in HSP and concluded that both the earliest and the more effective response could be obtained with the addition of corticosteroid injection in the therapy in appropriate HSP patients (17). Finally, Snels et al. published a meta-analysis of 14 different studies to identify an effective therapy method for treatment with HSP. They reported that the studies included in that review had many methodological deficiencies; it was impossible to determine the most effective therapy based on those studies. However, steroid therapy and FES were the most promising therapies among all those reviewed, and more comprehensive studies were needed on this subject (27). Overall results of this study can be accepted and generalized for other areas in Turkey, however generalizability of the data would be enhanced with larger scale studies.

In conclusion, it has been shown that each of the therapy modalities performed in each group for the treatment of HSP are effective, as the superiority of the combination of local corticosteroid injection and physical therapy modality over singly applied physical therapy modality has not been demonstrated.

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