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Original Research Article

A COMPARATIVE ANALYSIS OF ULTRASOUND THERAPY VERSUS CORTICOSTEROID INJECTION THERAPY IN THE MANAGEMENT OF LATERAL EPICONDYLITIS OF THE HUMERUS

Soumyadip Dutta[1], Sunit Hazra[2], Mainak Chandra[3], Rwivudeep Saha[4]

[1]Associate professor, Shri Ramkrishna Institute of Medical Sciences & Sanaka Hospital, West Bengal, India.
[2,3]Associate professor, [4]Senior Resident, Department of Orthopedics, R.G. Kar Medical College

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CorrespondingAuthor:
Dr.Soumyadip Dutta,
Email: soumyadiporth@yahoo.com

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Abstract

Background: Lateral epicondylitis of the humerus, or tennis elbow, is a common musculoskeletal condition characterized by pain and tenderness on the lateral aspect of the elbow. Various treatment modalities, including corticosteroid injections and ultrasound therapy, are utilized in its management, but their comparative efficacy remains unclear. This study aimed to compare the effectiveness of ultrasound therapy versus corticosteroid injection therapy in the management of lateral epicondylitis of the humerus. **Materials and Methods:** It was a non-randomised interventional type of study. Tennis elbow patients diagnosed by clinicians at orthopaedics OPD in Shri Ramkrishna Institute of Medical Sciences & Sanaka Hospital. 50 patients were in each group. After diagnosis, all the patients with tennis elbow in Group A were treated with corticosteroid injection(1 ml of triamcinolone acetate suspension 1% diluted with 1ml 1% lidocaine injected into the tendinous origin of common extensor tendon of forearm). A second injection was given after two weeks following first injection. In Group B were treated with ultrasound therapy at the intensity of 0.5-1.5 W/cm2 for 10 minutes, 3-4 times weekly for 4-6 weeks. Patients were advised to avoid any repetitive activity that provoked pain at lateral aspect of elbow and they were followed up at 6th week, 12th week and 24th week. Injection therapy was given in diabetic patients with tennis elbow after reducing their blood sugar to normal value. **Result:** The efficacy of corticosteroid injection is better in first 6-12 weeks after its application. An approach combining ultrasound therapy and avoidance of any activity that provokes pain, has a superior benefit to steroid injections in the long term and may be recommended over corticosteroid injections. However, patients with tennis elbow can be reassured that most cases will improve in the long term when given information and ergonomic advice about their condition. **Conclusion:** In corticosteroid injections offer effective short-term pain relief, a multimodal approach combining ultrasound therapy with activity modification demonstrates superior long-term outcomes in the management of lateral epicondylitis of the humerus. This approach presents a promising alternative to corticosteroid injections, offering sustained relief and functional improvement for patients with this challenging condition.

INTRODUCTION

Tennis elbow, also known as lateral epicondylitis, is characterized by inflammation and tenderness in the outer part of the elbow. It arises from repetitive strain on the tendons connecting forearm muscles to the lateral epicondyle of the elbow.[1] This repetitive motion causes damage to the tendons, leading to inflammation, pain, and tenderness. The condition is common among individuals engaging in activities such as tennis, carpentry, or other tasks involving repetitive forearm movements.[2]

The term "tennis elbow" was first introduced by Major in 1883,[3,4] defining it as a condition causing lateral elbow pain exacerbated by wrist extension. It affects both athletes and non-athletes, with a prevalence of 1 to 3% in the general population. Tennis elbow is more commonly observed in individuals over the age of 25, with a higher incidence in the fourth decade of life. While it occurs equally in both sexes,[5] it is less frequently

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reported among black individuals compared to whites.[6]

Treatment options for tennis elbow are contentious. Conservative methods include acupuncture, ultrasound therapy, steroid injections, counterforce bracing, and cross-friction massaging. However, the efficacy of these treatments varies, and some lack scientific support. Non-operative approaches often involve avoiding overuse, using counterforce bracing, steroid injections, and performing stretching exercises.[7] Despite numerous studies comparing treatment modalities, no gold standard management strategy has been established.

Our study aims to compare the effectiveness of corticosteroid injections versus ultrasound therapy in managing lateral epicondylitis over a one-year period. By evaluating the response and efficacy of these two methods, we seek to contribute to the understanding of optimal treatment approaches for this challenging condition.

MATERIALS AND METHODS

Type of Study: A non-randomized control trials.

Study Area: Study carried out in the Department of Orthpaedics, Shri Ramkrishna Institute of Medical Sciences & Sanaka Hospital, after approval from Hospital Ethics Committee.

Study Population: Tennis elbow patients diagnosed by clinicians at orthopaedics OPD at Shri Ramkrishna Institute of Medical Sciences & Sanaka Hospital, & Hospital, Kolkata, during the study period.

Selection Criteria: Age between 25 to 55 years, Consent from the patients. Patients of both sex, In bilateral cases most painful arm were included. And Radial tunnel syndrome. Posterior interosseous syndrome. Radial head fracture. Elbow pathology such as rheumatoid arthritis, osteoarthritis. Previous elbow surgery. Neurological disorder of painful extrimity. More than three local corticosteroid injection during six months before consultation cases were excluded.

Study Period: The study period was one year (January 2023 to December 2024) after getting permission from Institutional Ethics Committee and approval of West Bengal University of Health Sciences.

Sample Size: Sample size was calculated to compare the response between ultrasound therapy and corticosteroid injection in lateral epicondylitis of humerus. Using the data from previous study54, accepting α-error of 0.05 and the desired power of the study as 90%, 42 patients will be needed in each group. Expecting drop out rate of 20% in each group, 50 patients were in each group. Thus total sample size was 100.

Sampling Design: All patients those who fulfilled the criteria for study were divided equally into two groups

Group A: Corticosteroid injection was given (50 patients)

Group B: Ultrasound therapy was given (50 Patients)

Study Technique: History of present illness, any past illness, family history, personal history, allergy history, occupation, history of any previous operation or any complication associated with it were noted down in detail.

General Examination: Pallor, cyanosis, clubbing, oedema, jaundice, pulse rate, blood pressure and nutritional status were assessed.

Local Examination: Localised tenderness over the lateral aspect of elbow at the insertion of common extensor tendon of forearm.

Pain on resisted wrist extension with radial deviation and full pronation (cozen' s test).

Pain on resisted middle finger extension might indicate the involvement of Extensor Digitorum muscle and tendon of forearm(Maudsley's test).

Chair lift test = Lifting the back of a chair with a three-finger pinch (thumb, index long fingers) and the elbow fully extended.

Mill's test =pain in the area of the insertion at the lateral epicondyle while pronating the patient's forearm, fully flexing the wrist, the elbow extended.

Systemic Examination: Cardiovascular, respiratory, gastrointestinal and central nervous system were briefly assessed.

Laboratory investigation: The following laboratory investigations were carried out and evaluated.

X-RAY elbow joint both antero-posterior, and lateral view.

Complete haemogram, bleeding and clotting function.

Fasting and post-prandial blood sugar.

MRI, CT scan if needed.

After diagnosis, all the patients with tennis elbow in Group A were treated with corticosteroid injection(1 ml of triamcinolone acetate suspension 1% diluted with 1ml 1% lidocaine injected into the tendinous origin of common extensor tendon of forearm). A second injection was given after two weeks following first injection. Patients were advised to avoid any repetitive activity that provoked pain at lateral aspect of elbow and they were followed up at 6th week, 12th week and 24th week. Injection therapy was given in diabetic patients with tennis elbow after reducing their blood sugar to normal value. All the patients with tennis elbow in Group B were treated with ultrasound therapy at the intensity of 0.5-1.5 W/cm2 for 10 minutes,3-4 times weekly for 4-6 weeks. Ultrasound gel was used as coupling medium. All the patients were followed up at 6th week, 12th week and 24th week after the treatment and all of them were advised to avoid any repetitive activity that provoked pain.

Statistical Analysis: The results of our study were tabulated and subjected to statistical analysis (SPSS version 26.0). All continuous data were presented in the table as Mean±SD. Discrete categorical data

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were presented as absolute values. Comparisons for each demographic and clinical variable between the two groups were performed by t test for normally distributed variable and z test for categorical variables. The level of significance was set as $P<0.05$.

RESULTS

[Table 1] shows mean age of patients of Group A, was 37.7 with a standard deviation of 8.3 and the mean age of patients in Griup B, was 37.7 with a standard deviation of 8.3.There was no statistically significant differenceregarding the age of patients in the two group(P value1.000). The mean Visual Analog Scale(VAS) scoreof patients of Group A, before treatment(VAS 0 means VAS score at baseline or before treatment) was 65.7 with standard deviation of 2.2 and the values in Group B, were 63.6 and 2.2 respectively. There was statistically significant difference regarding the VAS score of patients in two group(P value 0.000). The mean Objective Grip Strength(OGS) scoreof patients of Group A before treatment(OGS 0 means OGS score at baseline or before treatment) was 22.4 with standard deviation of 6.5 and the values in Group B, were 22.3 and 7.3 respectively. There was no statistically significant difference regarding the OGS score of patients in two group(P value 0.941). Independent t test was used to detect statistically significant difference in VAS and OGS in each group.

[Table 2] shows 36 out of 50 patients of Group A, were male and 29 out of 50 patients of Group B, were male and there was no statistically significant difference in sex ratio between the two Group(P value 0.208). In each group, 7 out of 50 patients had slight localisedtenderness(LT) in lateral aspect of elbow, 29 out of 50 patients had moderate, 14 out of50 patients had severe localised tenderness. Also 6 out of 50 patients in group A and 8 out of 50 patients in Group B, had slight pain on Resisted Dorsiflexion of Wrist(RDF) which was statistically not significant(P value 0.773).Also 44 out of50 patients in the group A and 42 out of 50 patients in Group B had severe pain on RDF which was statistically not significant(P value 0.773). All these data were taken at baseline.

[Table 3] shows changes in mean VAS score and mean OGS score in patients of Group A undergoing corticosteroid injection therapy over the 24 week period.

[Table 4] shows changes in proportion of patients based on the severity ofLT and RDF in patients undergoing corticosteroid injection therapy. At 6 weeks 25 out of 50 patients ie 50% had absent LT, at 12 weeks 44 out of 50 patients i.e. 88% had absent LT and at 24 weeks, 30 out of 50 patients i.e. 60% had absent pain. Also 26 out of 50 patients(52%) at 6 weeks, 33 patients (66%) at 12 weeks, 21 patients(42%) at 24 weeks had no RDF.

[Table 5] shows decrease in mean VAS score and improvement in mean OGS score in patients of Group B undergoing ultrasound therapy over the 24 week period.

[Table 6] shows changes in proportion of patients based on the severity ofLT and RDF in patients undergoing ultrasound therapy. At 6 weeks 5 out of 50 patients ie 10% had absent LT, at 12 weeks 32 out of 50 patients i.e. 64% had absent LT and at 24 weeks, 44 out of 50 patients i.e. 88% had absent pain. Also 4 out of 50 patients(8%) at 6 weeks, 8 patients (16%) at 12 weeks, 26 patients(52%) at 24 weeks had no RDF.

[Table 7] shows difference in mean VAS score and mean OGS score over the 24 week period between control group(corticosteroid injection therapy) and intervention group(ultrasound therapy). Unpaired t test was used to detect statistically significant difference in VAS score between the two group and that ofOGS score between the two group.

[Table 8] shows difference in the proportion of patients with severe LT and severe RDF between control group(corticosteroid injection) and intervention group(ultrasound therapy) over the 24 week period and z test was used to detect statistically significant difference in severe LT between the two group and that of severe RDF between the two group over the 24 week period.

[Table 9] shows difference in the percentage improvement in mean VAS score between control group (corticosteroid injection) and intervention group(ultrasound therapy) over the 24 week period and also that of mean OGS score between two group over the 24 week period.Unpaired t test was used to detect statistically significant difference in VAS score betweentwo group and that of OGS score between two group over the 24 week period.

Table 1: Difference in the mean age, VAS and OGS of the control and intervention group at baseline

	Control (corticosteroid)Group A(n=50)	Intervention (ultrasound)Group B(n=50)	t test	p value
Age	37.7 ± 8.3	37.7 ± 8.3	-0.00	1.000
VAS 0	65.7 ± 2.2	63.6 ± 2.2	4.87	0.000
OGS 0	22.4 ± 6.5	22.3 ± 7.3	0.07	0.941

Table 2: Difference in sex, LT and RDF of the control and intervention group at baseline

		Control (corticosteroid)Group A(n=50)	Intervention (ultrasound)Group B(n=50)	z test	p value
Sex	Male	36	29	1.26	0.208
LT	Absent	0	0	-	-
	Slight	7	7	-	-

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	Moderate	29	29	-	-
	Severe	14	14	-	-
RDF	Absent	0	0	-	-
	Slight	6	8	0.29	0.773
	Moderate	0	0	-	-
	Severe	44	42	0.29	0.773

Table 3: Changes in mean VAS and OGS in patients undergoing CST over the 24 week period

	Baseline	At 6 weeks	At 12 weeks	At 24 weeks
VAS	65.7 ± 2.2	22.9 ± 3.7	7.3 ± 5.6	19.4 ± 10.0
OGS	22.4 ± 6.5	31.9 ± 9.0	38.6 ± 10.1	35.4 ± 9.5

Table 4: Changes in the proportion of patients based on severity in patients undergoing CST over the 24 week period

		Baseline	At 6 weeks	At 12 weeks	At 24 weeks
LT	Absent	0	25	44	30
	Slight	7	15	6	15
	Moderate	29	9	0	5
	Severe	14	1	0	0
RDF	Absent	0	26	33	21
	Slight	6	16	15	24
	Moderate	0	0	0	0
	Severe	44	8	2	5

Table 5: Changes in mean VAS and OGS in patients undergoing ultrasound over the 24 week period

	Baseline	At 6 weeks	t value	P value	At 12 weeks	t value	P value	At 24 weeks	t value	P value
VAS	63.6 ± 2.2	36.5 ± 2.2	48.23	0.000*	26.4 ± 2.2	63.27	0.000*	6.6 ± 6.4	44.57	0.000*
OGS	22.3 ± 7.3	27.1 ± 8.4	2.28	0.026*	32.2 ± 9.8	4.29	0.000*	37.1 ± 10.4	14.80	0.000*

Table 6: Changes in the proportion of patients based on severity in patients undergoing ultrasound over the 24 week period

		Baseline	At 6 weeks	At 12 weeks	At 24 weeks
LT	Absent	0	5	32	44
	Slight	7	20	10	6
	Moderate	29	19	8	0
	Severe	14	6	0	0
RDF	Absent	0	4	8	26
	Slight	8	26	27	20
	Moderate	0	0	0	0
	Severe	42	20	15	4

Table 7: Difference in the mean VAS scores and OGS score over the 24 week period between control and intervention groups

		Control(Corticosteroid)Group A	Intervention(Ultrasound)Group B	t test	p value
VAS	6 weeks	22.9 ± 3.7	36.5 ± 2.2	22.34	0.000
	12 weeks	7.3 ± 5.6	26.4 ± 2.2	22.45	0.000
	24 weeks	19.4 ± 10.0	6.6 ± 6.4	7.62	0.000
OGS	6 weeks	31.9 ± 9.0	27.1±8.4	2.76	0.006
	12 weeks	38.6 ± 10.1	32.2±9.8	3.22	0.001
	24 weeks	35.4 ± 9.5	37.1 ± 10.4	0.85	0.395

Table 8: Difference in the proportion of patients with severe symptoms between control and intervention groups over the 24 week period

		Corticosteroid	Ultrasound	z test	p value
Severe LT	6 weeks	1	6	1.57	0.116
	12 weeks	0	0	-	-
	24 weeks	0	0	-	-
Severe RDF	6 weeks	8	20	2.45	0.014*
	12 weeks	2	15	3.19	0.001*
	24 weeks	5	4	0.00	1.00

Table 9: Difference in the percentage improvements in mean scores between control and intervention groups over the 24 week period

		Corticosteroid	Ultrasound	t test	p value
VAS	6 weeks	65.2 ± 5.1	42.7 ± 2.7	27.57	0.000
	12 weeks	89.0 ± 8.2	58.5 ± 3.4	24.30	0.000
	24 weeks	70.6 ± 14.8	89.6 ± 10.1	7.50	0.000
OGS	6 weeks	29.6 ± 8.2	23.7 ± 12.7	2.76	0.006
	12 weeks	76.2 ± 27.5	48.0 ± 21.9	5.67	0.000
	24 weeks	61.8 ± 26.4	74.4 ± 43.4	1.75	0.082

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DISCUSSION

Lateral epicondylitis remains one of the most perplexing disorders of the musculoskeletal system. It was first described by Runge in 1873.[8] It is an acute or chronic inflammation of the tendons that join the forearm muscles on the outside of the elbow (lateral epicondyle).

So treatment of tennis elbow is often frustrating experience for the clinicians due to frequent failure of obtaining a symptomatic improvement in the patients. This failure is equally apparent in both conservatively and surgically treated patients. Therefore, the management of tennis elbow both at early and late stages has been suggestive to be primarily a conservative approach.[9]It is therefore, important to substantiate an effective, non-invasive, conservative therapy for this disabling affliction.

Several studies have evaluated the efficacy of different conservative therapy in treatment of lateral epicondylitis in terms of pain intensity, grip strength, pinch strength, localised tenderness, pain intensity on resisted dorsiflexion of wrist. In a previous study, success rate at 6 weeks were 92% for corticosteroid injection and 47% for ultrasound therapy. Success rate at 52 weeks were 69% for corticosteroid injection and 91% for ultrasound therapy.

We tried to objectively determined the efficacy of two conservative treatment modalities i.e. ultrasound therapy(one of the commonest physiotherapy modalities) and corticosteroid injection therapy in terms of VAS score, OGS score, localised tenderness and severity of RDF in 100 patients with tennis elbow with 50 patients in each group. The number of patients who has to be enrolled in each group was predetermined, the patients were non-randomised following inclusion and exclusion criteria followed by outcome measurements at 6 weeks, 12 weeks and 24 weeks after application of these two treatment modalities, one in each group.

As per our study, percentage of improvement in mean VAS score for CST group, at 6 weeks, 65.2%(22.9±3.7), at 12 weeks 89%(7.3±5.6), at 24 weeks 70.6%(19.4±10.0) and for UST group, at 6 weeks, 42.7%(36.5±2.2), at 12 weeks 58.5%(26.4±2.2), at 24 weeks 89.6%(6.6±6.4) i.e. Severity of pain was improved which was statistically significant($P<0.001$) in CST group within 12 weeks but this picture was reversed from 12 weeks onwards and severity of pain was improved in UST group at 24weeks and there was statistically significant difference between the two group($P<0.001$). Percentage of improvements in OGS score for CST group at 6 weeks 29.6%(31.9±9.0), at 12 weeks 76.2%(38.6±10.1), at 24 weeks 61.8%(35.4±9.5) and for UST group at 6 weeks 23.7%(27.1±8.4), at 12 weeks 48%(32.2±9.8), at 24 weeks74.4%(37.1±10.4) i.e. OGS improved at 6 weeksand 12 weeks in CST group but after 24 weeks OGS improved in UST group which was statistically significant($P=0.000$)but there was no statistically significant difference between the two group($P=0.395$). Percentage of improvement in severity of RDF for CST group at 6 weeks 52%, at 12 weeks 66%, at 24 weeks 42% and for UST group at 6 weeks 8%, at 12 weeks 16%, at 24 weeks 52% ie Severe RDF, which was more significantly(statistically) present at 6 weeks($P=0.014$) and 12 weeks($P=0.001$), in UST group than in CST group but after 24 weeks severe RDF was reduced in both group and there was statistically no significant difference between the two group($P=1.00$). Percentage of improvement in severity of LT for CST group at 6 weeks 50%, at 12 weeks 88%, at 24 weeks 60% and for UST group at 6 weeks 10%, at 12 weeks 62%, at 24 weeks 88%. Severe LT was absent in both group after 24 weeks.

J. A. N Verhaar et al,[10] in 1996 conducted a study on106 patients with tennis elbow to compare the effects of local corticosteroid injection with physiotherapy as advocated by cyriax in treatment of tennis elbow. The main outcome measures were severity of pain, pain provoked by resisted dorsiflexion of wrist and patient satisfaction. After 6 weeks of treatment, corticosteroid injections were better than the Cyriax physiotherapy regimen. The success rate in the injection group (69%) was somewhat lower than previously reported results. Valtonen (1967),[11] reported a success rate of 86% and Hughes and Currey (1969),[12] of 95%. Day et al (1978),[13] showed that 92% of their patients improved or were cured with corticosteroid injections and results in the physiotherapy group (27%) are also somewhat lower than the 29% to 53% success rate obtained by other authors (Hughes and Currey 1969; Devereaux et al 1985).[14] After an initially successful six weeks of treatment, many patients had recurrence of pain, 34% in the corticosteroid injection group. At six months, however, most studies reported a high recurrence rate, 66% in one group of patients. After 6 weeks of treatment, the increase in the grip strength in the injection group(61.5%,mean 29.1±15.9) was significantly greater than that in the physiotherapy group (25.4%,mean 25.6±13.7) but after 52 weeks there was no significant difference in grip strength improvement between the two group. There was significant improvement in severity of localised tenderness in CST group(50%) than that in physiotherapy group(7%) after 6 weeks treatment but this improvement was better in physiotherapy group(30%) after 52 weeks than in CST group(26%). Also there was significant improvement in severity of RDF for CST group(50%) after 6 weeks than physiotherapy group(10%) but after 52 weeks this improvement was better in physiotherapy group(43.3%) than in CST group(30.7%). No infection occurred at the injection site.

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We can say that corticosteroid injection therapy affects better and last for short duration usually upto 6 to12 weeks and after 12 weeks onwards its effect gradually decreases and mild symptoms persist in most of the cases, although severe symptoms improves even after 12 weeks onwards. On the other hand, the effect of ultrasound therapy lasts longer with better outcome than corticosteroid injection therapy. Although few patients with severe symptoms still persist even after CST and UST therapy and that may be due to treatment failure, resistant cases, long standing cases with only degenerative change that may require further better treatment like autologous blood injection, open surgical procedure, or arthroscopic procedure. In our study there was few insignificant outcome and that may be due to less sample size, inadequate history given by the patients, patients might have some hesitancy of performing grip movement due to fear of pain at the lateral aspect of elbow, there may be some degenerative muscle atrophy and that will be under consideration.

However the present study has some limitation as well. Most important limitation is the fact that the study was unblinded. Secondly the sample size is less in our study. Another limitation is that in long standing cases of lateral epicondylitis of humerus, degenerative changes mostly seen in common extensor origin of forearm, that certainly could have influenced the effect of these two treatment modalities.

CONCLUSION

We conclude our study with the follow up outcome of patients with lateral epicondylitis of humerus that corticosteroid injections act better for short term pain relief upto six to twelve weeks and an approach combining ultrasound therapy with avoidance of any activity that provokes lateral epicondylitis pain, has a superior benefit to steroid injections in the long term and may be recommended over corticosteroid injection. However those resistant or failure cases may require further better treatment like autologous blood injection, platelet rich plasma therapy, low level laser therapy, injection of sclerosing agent(polidocanol), application of glyceryl-trinitrate patches, although require further research before being used as a routine treatment.However, patients with tennis elbow can be reassured that most cases will improve in the long term when given information and ergonomic advice about their condition.

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