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Comparative study between corticosteroid injection and ultrasound therapy in treatment of lateral epicondylitis of humerus

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Abstract
Tennis elbow or lateral epicondylitis is a condition in which the outer part of the elbow becomes sore and tender. The forearm muscles and tendons become damaged from overuse - repeating the same strenuous motions again and again. This leads to inflammation, pain and tenderness on the outside of the elbow.
Any activity, including playing tennis, which involves the repetitive use of the extensor muscles of the forearm can cause acute or chronic tendinitis of the tendinous insertion of these muscles at the lateral epicondyle of the elbow.
It is a common pathology of both athletes and non-athletes affecting 1 to 3% population at large. Tennis elbow is seldom observed in subjects under the age of 25 years and black people are apparently affected less frequently than the whites. Tennis elbow has been reported to be four times more common in the fourth decades of life.
Currently available conservative treatment methods include acupuncture, ultrasound therapy, steroid injection, counter force bracing, cross friction massaging. Some of these treatment modalities have no scientific basis. The most successful non operative treatment consists of avoidance of overuse counterforce bracing to relieve the insertion of extensor tendons, steroid injection into the affected area and stretching exercises.

Keywords: Lateral epicondylitis, ultrasound therapy, corticosteroid injection, humerus, pain

Introduction
Tennis elbow or lateral epicondylitis is a condition in which the outer part of the elbow becomes sore and tender. It is an acute or chronic inflammation of the tendons that join the forearm muscles on the outside of the elbow (lateral epicondyle). The forearm muscles and tendons become damaged from overuse — repeating the same strenuous motions again and again. This leads to inflammation, pain and tenderness on the outside of the elbow [1]. Some clinician terms it a degenerative process characterised by an abundance of fibroblast, vascular hyperplasia and unstructured collagen at the origin of common extensor muscle [2].
Any activity, including playing tennis, which involves the repetitive use of the extensor muscles of the forearm can cause acute or chronic tendinitis of the tendinous insertion of these muscles at the lateral epicondyle of the elbow. The condition is common in carpenters and other labourers who swing a hammer or other tool with the forearm.
Runge is usually credited for the first description of the condition, in 1873 [3]. In the english literature, the term tennis elbow was first used in 1883 by major in his paper lawn tennis elbow [4, 5]. He defined it as a medical condition that causes pain on the lateral side of elbow and is aggravated by wrist extension. It is a common pathology of both athletes and non-athletes affecting 1 to 3% population at large. Tennis elbow is seldom observed in subjects under the age of 25 years and black people are apparently affected less frequently than the whites [6]. Tennis elbow has been reported to be four times more common in the fourth decades of life [7]. The incidence rate has been shown to be similar in both sexes [8].
However, the choice of treatment options for this condition is even more controversial. Currently available conservative treatment methods include acupuncture, ultrasound therapy, steroid injection, counter force bracing, cross friction massaging. Some of these treatment modalities have no scientific basis. The most successful non operative treatment consists of avoidance of overuse counterforce bracing to relieve the insertion of extensor tendons, steroid injection into the affected area and stretching exercises.

Although few, comparison between treatment alternatives has been studied in the literature with conflicting results and no single intervention has been proven to be the most efficient [9-13] and there is no standard method whereby one can manage this condition as a gold standard. Accordingly, the aim of our study is to compare the response and efficacy between two methods, i.e., corticosteroid injection and ultrasound therapy in patients of lateral epicondylitis of humerus in one year period.

Purpose

To compare the response between ultrasound therapy and corticosteroid injection therapy in lateral epicondylitis of humerus.

Variables to be evaluated

Age of the patient, etiology/cause, occupation of the patient, associated injuries (e.g. neuro-vascular status, tendon injury), pain, and instability, activities of daily living, motion and function.

Study Design

Our study was a non-randomised interventional type of study.

Setting

North Bengal Medical College and Research hospital-Darjeeling

Study Duration

1st April 2014 to 1st April 2015

Methods and Materials

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/cm^2 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.

Data Collection and Statistical Analysis

The researcher collected data from the patients. Predesigned data collection sheets were used. The data was analyzed using SPSS version 19 and descriptive statistics for sample variables presented in form of tables and graphs.

Repeated measures ANOVA were used to show any variations in the dependent variables while Pearson's correlation was used to check for any existing relationship in the variables. Data was considered significant at $p \leq 0.05$ and presented with 95% confidence interval. Data collected was analyzed and presented in the form of tables and charts.

Results

Total sample size in our study was 100. The data available for statistical analysis contained 50 patients in Group A (corticosteroid injection group) and 50 patients in Group B (ultrasound therapy group).

The results of our study were tabulated and subjected to statistical analysis (SPSS version 12.0 for windows, Chicago, IL, Inc). All continuous data were presented in the table as Mean ± SD. Discrete categorical data 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 $p<0.05$.

Lateral epicondylitis remains one of the most perplexing disorders of the musculoskeletal system. It was first described by Runge [3] in 1873. It is an acute or chronic inflammation of the tendons that join the forearm muscles on the outside of the elbow (lateral epicondyle). The forearm muscles and tendons become damaged from overuse - repeating the same strenuous motions again and again. This leads to inflammation, pain and tenderness on the outside of the elbow [1]. Some clinician terms it a degenerative process characterised by an abundance of fibroblast, vascular hyperplasia and unstructured collagen at the origin of common extensor muscles [2]. The term tennis elbow is misnomer as it rarely occurs in tennis players. Various treatments methods are available in treatment of lateral epicondylitis but there is no standard method whereby one can manage this condition as a gold standard.

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 this 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 weeks 74.4%

(37.1±10.4) i.e. OGS improved at 6 weeks and 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.

Smidt *et al*. evaluated a six week combined programme of massage, US, and exercises, and compared this group with a corticosteroid injection group and a wait and see (control) group. At six weeks, there were significant differences between all three groups. The success rate at six weeks between the combined physical intervention and control group was weakly in favour of the intervention and this was maintained at 12 months, although these differences were not significant. At six weeks the corticosteroid injection group was significantly better than the physical intervention group in PVAS, MGS (maximum grip strength), pressure pain threshold, and PFGS (pain free grip strength). However, these differences were no longer evident by three months, and then reversed, with a significant difference, favouring the physical intervention group at six and twelve months. From six months onwards, the combined physical intervention performed significantly better than the corticosteroid group, indicating that this was superior to corticosteroid injection in the long term but not significantly different from the control group.

In previous study, at 6 weeks, corticosteroid injections were significantly better than all other therapy options for all outcome measures. Success rates were 92% (57) compared with 47% (30) for ultrasound therapy and 32% (19) for wait-and-see policy. However, recurrence rate in the injection group was high. Long-term differences between injections and ultrasound therapy were significantly in favour of ultrasound therapy. Success rates at 52 weeks were 69% (43) for injections, 91% (58) for physiotherapy, and 83% (49) for a wait-and-see policy. In our study, success rates (on the basis of vas score), at 6 weeks were 65.2% for corticosteroid injection therapy, 42.7% for ultrasound therapy but at 24 weeks, success rate were 70.6% for corticosteroid injection therapy and 89.6% for ultrasound therapy which was statistically significant. So long-term differences between injections and ultrasound therapy were significantly in favour of ultrasound therapy. Similarly, on the basis of ogs score, severity of resisted dorsiflexion of wrist and localised tenderness, long term effect of ultrasound therapy was significantly better than corticosteroid injection therapy.

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.

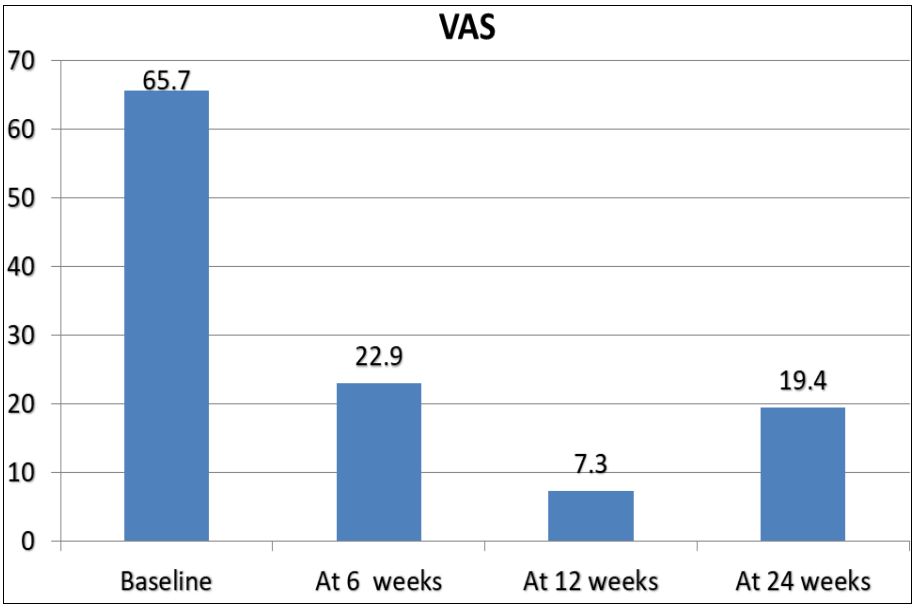

Fig 1: Figure showing decrease in mean VAS scores over 24 weeks on CST treatment

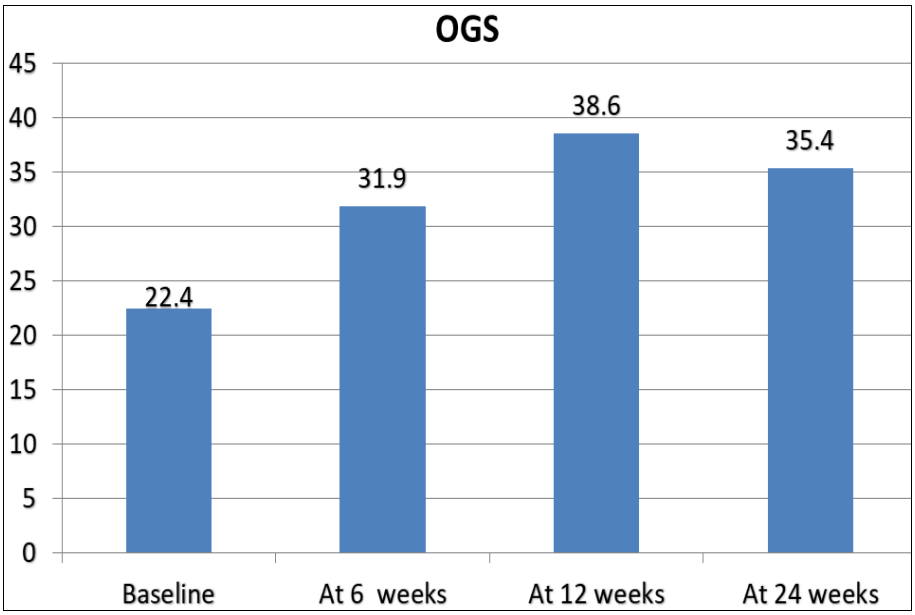

Fig 2: Figure showing improvements in OGS over 24 weeks on CST treatment

Table 1: 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

Data expressed in number

Table 1 shows changes in proportion of patients based on the severity of LT 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.

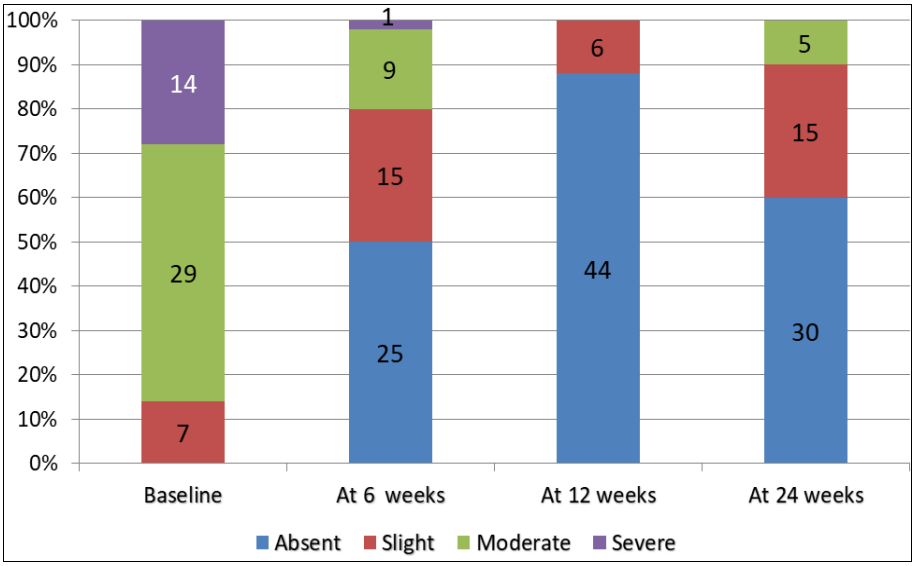

Fig 3: Distribution of subjects undergoing CST by severity of LT over the 24 week period

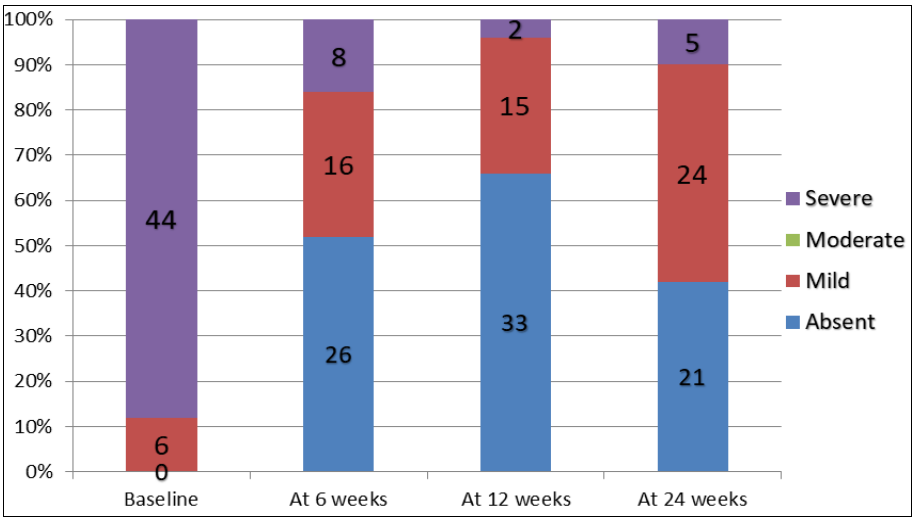

Fig 4: Distribution of subjects undergoing CST by severity of RDF over the 24 week period

Table 2: 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*

Data expressed as mean ± SD. Test done: paired t test (p<0.05 considered significant)
*statistically significant

Table 2 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.

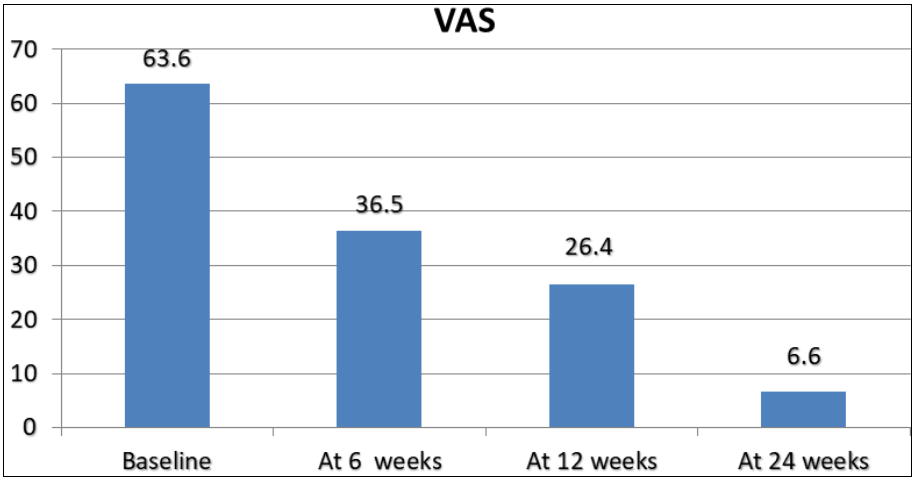

Fig 5: Figure showing decrease in mean VAS scores over 24 weeks on ultrasound

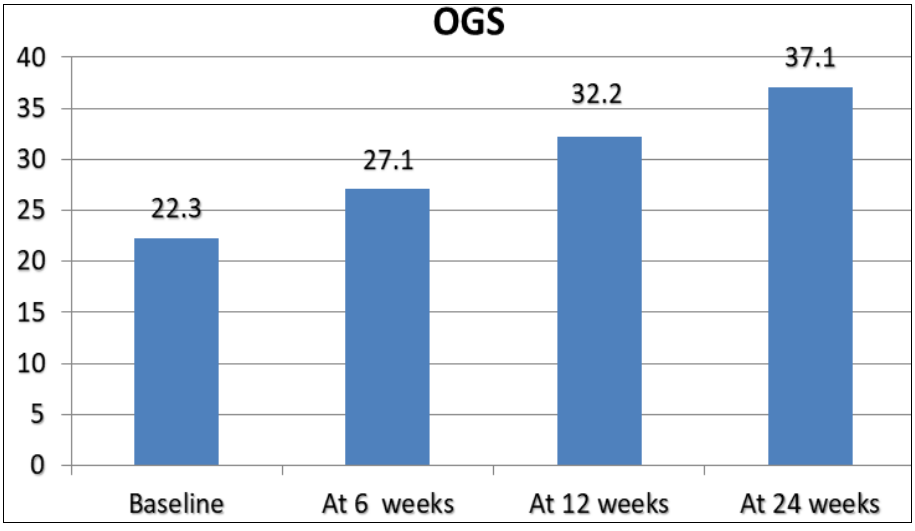

Fig 6: Figure showing improvements in OGS over 24 weeks on ultrasound

Table 3: 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

Data expressed in numbers

Table 3 shows changes in proportion of patients based on the severity of LT 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.

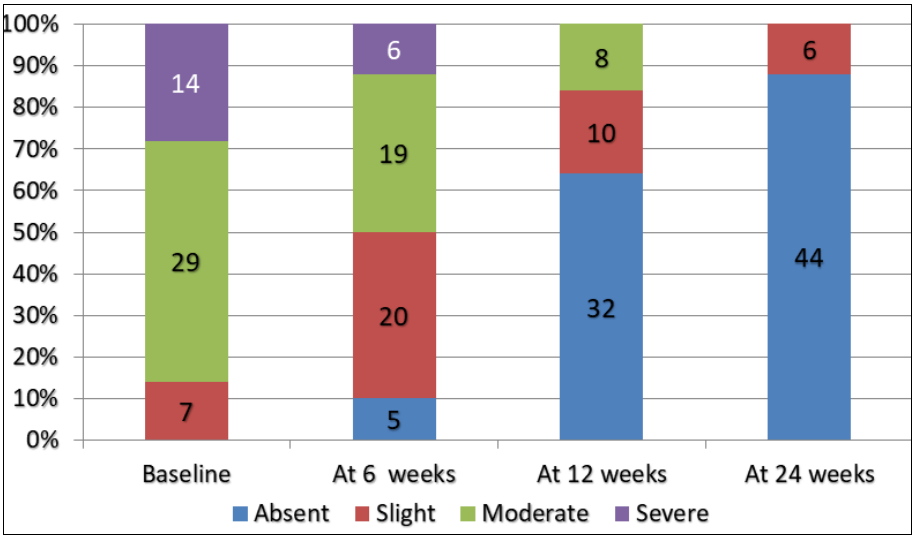

Fig 7: Distribution of subjects undergoing USG by severity of LT over the 24 week period

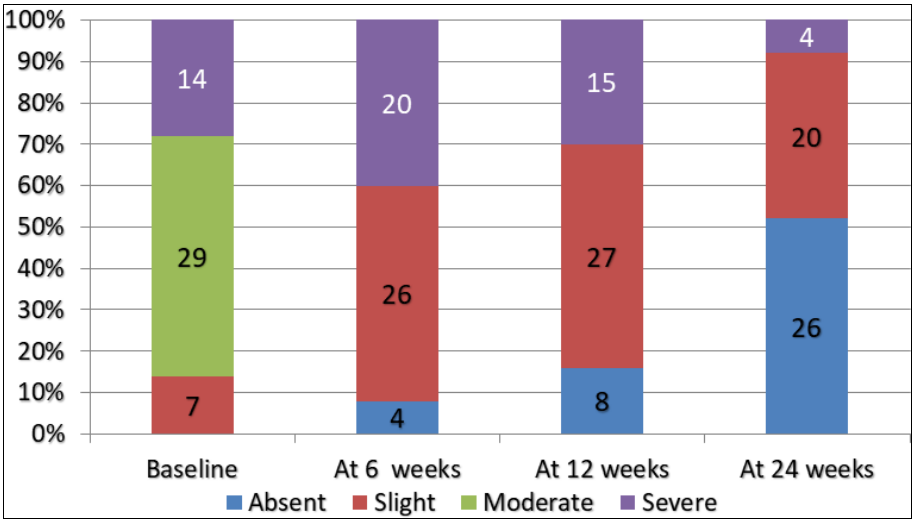

Fig 8: Distribution of subjects undergoing USG by severity of RDF over the 24 week period

Table 4: 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

Data expressed as mean ± SD. Test done: unpaired t test (p<0.05 considered significant)

Table 4 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 of OGS score between the two group.

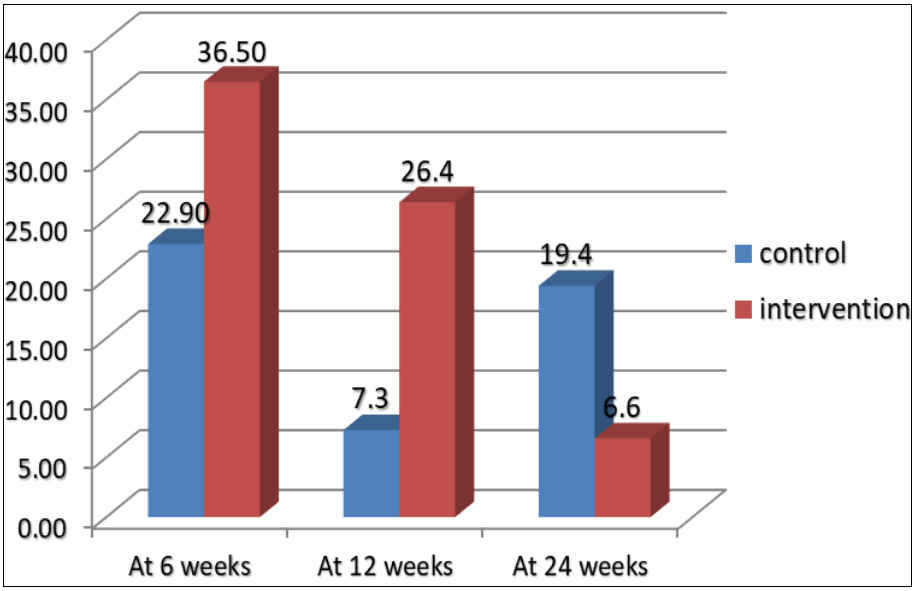

Fig 9: Figure showing difference in mean VAS score between control and intervention group over 24 week period

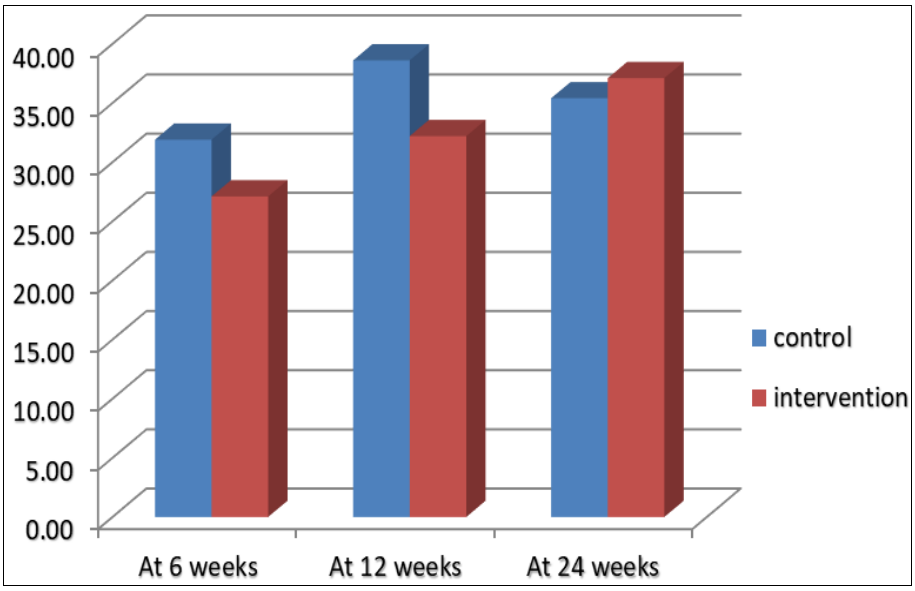

Fig 10: Figure showing difference in maen OGS score between control and intervention group over 24 week period

Table 5: 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

Data expressed in number. Test done: z test (p<0.05 considered significant)

Table 5 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 6: 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

Data expressed as mean ± SD. Test done: unpaired t test (p<0.05 considered significant)

Table 6 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 between two group and that of OGS score between two group over the 24 week period.

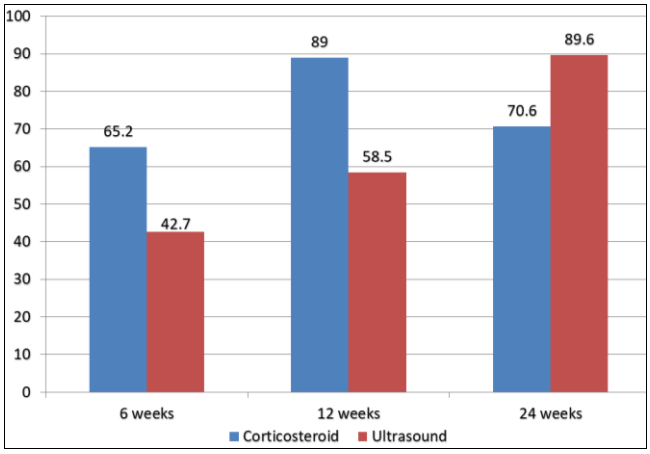

Fig 11: Figure showing percentage of improvement in mean VAS scores over 24 weeks between control group (Corticosteroid injection) and intervention group (Ultrasound therapy)

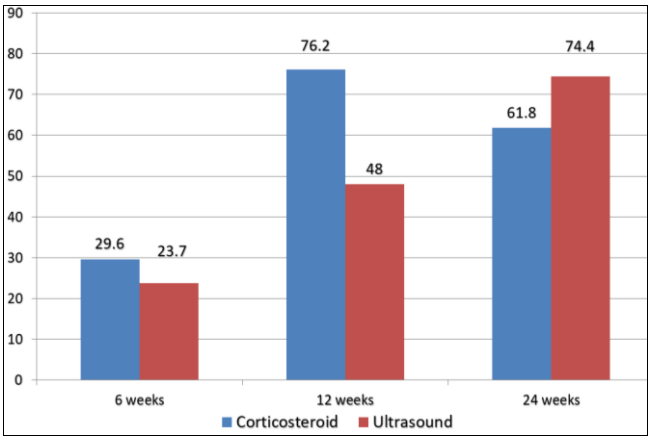

Fig 12: Figure showing percentage of improvements in OGS score over 24 weeks between control group (Corticosteroid injection) and intervention group (Ultrasound therapy)

Illustration Image

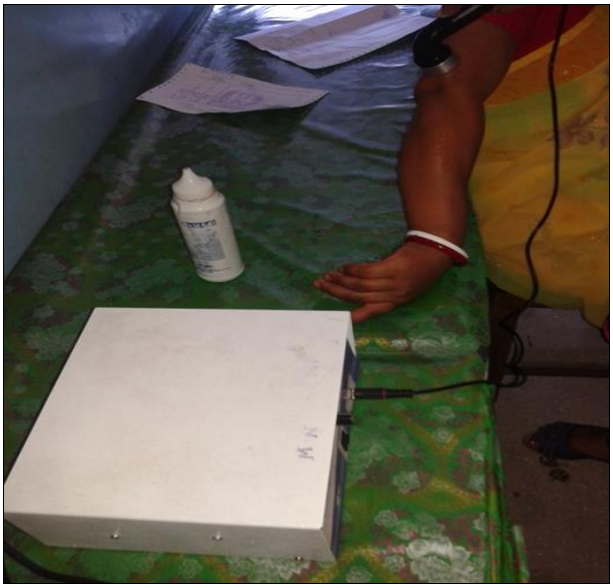

Fig 13: Ultrasound therapy administered over common extensor origin of forearm

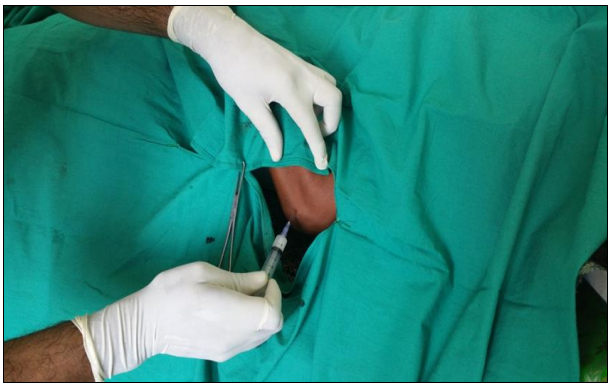

Fig 14: Corticosteroid injection infiltrated at common extensor origin of forearm

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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