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Effects of Dextrose versus Corticosteroid Injection Guided by Ultrasound in Treatment of Lateral Epicondylitis

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Background: One of the most common causes of elbow pain is lateral epicondylitis (LE). ultrasound (US) is diagnostic and therapeutic method.
Aim of the Work: The comparison between the effects of dextrose and corticosteroid injection guided by ultrasound in treatment of LE was the aim of this work.
Patients and Methods: This research was performed on 60 cases had chronic LE (local tenderness to palpation at lateral epicondyle and pain on resisted extension of middle finger or wrist) randomly classified into two equal groups depending on the treatment line, group A involved 30 cases subjected to2 injections of dextrose solution. Group B involved 30 cases treated by 2 injections with corticosteroid solution. Both groups were US guided. Patient evaluation at base line and after one month from last injection.
Results: In both groups, there was a significant improvement of the degree of tenderness, patient rated tennis elbow evaluation, visual analog scale and ultrasound changes, no significant improvement in group A more than group B.
Conclusion: Dextrose prolotherapy proved to be as effective as corticosteroid in chronic LE treatment.

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Keywords: Dextrose prolotherapy; lateral epicondylitis; ultrasound.

1. INTRODUCTION

Lateral epicondylitis (LE) it is a painful enthesopathy or common extensor tendon tendinosis in the fibro-osseous junction at the elbow outer region. Evidence indicates that the main factor included is a degenerative rather than an inflammatory process [1].

Overload injury and repetitive micro trauma are suggested pathogenesis. The main clinical features, tenderness and pain over the elbow lateral side increased with activity especially resisted wrist extension , and improved with rest [2].

Numerous therapeutic modalities for LE have been described. Traditional treatments involve activity modification, icing, rest, bracing, nonsteroidal anti-inflammatory drugs, and physical therapy. Meanwhile,, none of these treatments has shown to be generally effective [3].

Corticosteroid injection is one of the most frequent treatment of LE, which is used to decrease inflammation in cases with a variety of chronic tendinopathies [4].

To initiate an inflammatory cascade at the site of injection, prolotherapy solutions are used which promotes proliferation of fibroblast and subsequent collagen synthesis, leading to a stronger and tighter ligament or tendon which leads to reduced pain and improved function [5].

Ultrasound has emerged as an effective, low-cost, and radiation-free imaging technique that can be used for diagnostic purposes as also to guide percutaneous procedures to treat LE with a minimally invasive approach [6].

Our research aimed to compare the effects of dextrose and corticosteroid injection guided by ultrasound in treatment of LE.

2. PATIENTS AND METHODS

This research was performed on 60 individuals with chronic LE (local tenderness to palpation at LE and pain on resisted extension of wrist or middle finger) [3].

Patients with history of steroid injections within 6 months before intervention, patients known with thrombocytopenia, coagulopathy or bleeding diathesis, inflammatory arthropathy as (Rheumatoid Arthritis and gouty arthritis), Pregnancy, lactation and Diabetic patients were excluded from the study

- patients were divided randomly into two groups, each of them consists of 30 patients were treated under complete aseptic technique by ultrasound guided injection into maximal point of tenderness at LE of the elbow joint, 2 injections for each group the first at base line and then after 2 weeks.
- **Group A:** injected with dextrose solution (1 ml of dextrose 12.5%, 1 ml of mepecaine 3%).
- **Group B:** injected with corticosteroid (1 ml methyl prednisolone, 1ml mepecaine 3%).
- All patients were assessed before injection and after one month from last injection: tenderness at the lateral epicondyle, Clinical tests (Cozen, Mills& Maudsley tests), Modified Mayo clinic performance index for the elbow, visual analog scale (VAS), The Patient Rated Tennis Elbow Evaluation (PRTEE) and Ultrasound assessment for hypo echogenicity, bony irregularity, Tendon thickness and Power Doppler signals.

2.1 Statistical Analysis of the Data

IBM SPSS software package version 20.0 was used to analyse the data. (IBM Corp., Armonk, New York). The normality of a variable's distribution was checked using the Kolmogorov-Smirnov test. The Chi-square test was used to compare categorical variables between groups (Fisher or Monte Carlo). For normally distributed quantitative data, the student t-test was employed, whereas Mann Whitney was used for non-normally distributed quantitative variables. Quantitative variables that were not normally distributed were compared using the Wilcoxon signed ranks test. McNemar-Bowker and Marginal Homogeneity Tests were used to compare categorical variables between phases. It was determined that the findings had a significance level of 5%.

3. RESULTS

Table 1. Comparison between the two studied groups according to demographic data and clinical test

	Group A (n = 30)	Group B (n = 30)	Test of Sig.	p
Age (years)				
Min. – Max.	31.0 – 56.0	28.0 – 55.0	t=	0.234
Mean ± SD.	41.90 ± 7.35	39.40 ± 8.70	1.202	
Median (IQR)	42.50 (35.0 – 45.0)	40.0 (31.0 – 43.0)		
Gender				
Male	4(13.3%)	10(33.3%)	χ^2=3.354	0.067
Female	26(86.7%)	20(66.7%)		
Duration of pain				
Min. – Max.	6.0 – 24.0	6.0 – 18.0	U=	0.107
Mean ± SD.	11.33 ± 5.21	9.37 ± 3.45	342.0	
Median (IQR)	10.0 (8.0 – 12.0)	8.0(7.0 – 12.0)		
Visual analog scale				
At baseline				
Min. – Max.	1.0 – 3.0	2.0 – 3.0	U=	0.076
Mean ± SD.	2.53 ± 0.63	2.80 ± 0.41	354.0	
Median (IQR)	3.0 (2.0 – 3.0)	3.0 (3.0 – 3.0)		
After one month				
Min. – Max.	0.0 – 2.0	0.0 – 2.0	U=	0.703
Mean ± SD.	0.87 ± 0.63	0.80 ± 0.55	428.0	
Median (IQR)	1.0 (0.0 – 1.0)	1.0 (0.0 – 1.0)		
Z (p_1)	**4.909*(<0.001*)**	**4.919*(<0.001*)**		
Modified mayo clinic index				
At baseline				
Min. – Max.	5.0 – 10.0	6.0 – 10.0	U=	0.911
Mean ± SD.	8.63 ± 1.13	8.73 ± 1.08	443.0	
Median (IQR)	9.0 (8.0 – 9.0)	9.0 (8.0 – 10.0)		
After one month				
Min. – Max.	2.0 – 6.0	2.0 – 6.0	U=	0.939
Mean ± SD.	3.50 ± 1.28	3.47 ± 1.04	445.0	
Median (IQR)	3.0 (2.0 – 5.0)	3.0 (3.0 – 4.0)		
Z (p_1)	**4.811*(<0.001*)**	**4.667*(<0.001*)**		
Patient rated tennis Elbow evaluation				
At baseline				
Min. – Max.	45.0 – 70.0	45.0 – 65.0	U=	0.093
Mean ± SD.	52.67 ± 6.40	56.33 ± 8.19	340.0	
Median (IQR)	50.0 (50.0 – 55.0)	55.0 (50.0 – 65.0)		
After one month				
Min. – Max.	0.0 – 85.0	60.0 – 85.0	U=	0.289
Mean ± SD.	67.0 ± 16.43	72.67 ± 5.98	380.0	
Median (IQR)	70.0 (60.0 – 80.0)	75.0 (70.0 – 75.0)		
Z (p_1)	**3.839*(<0.001*)**	**4.737*(<0.001*)**		

IQR, interquartile range

- *There is significant improvement in VAS, Mayo clinic performance index and Patient rated tennis Elbow evaluation in the 2 groups after treatment in comparison with before treatment.*

Table 2. Comparison between the two studied groups according to ultra-sonographic data at base line and after one month

		Group A (n = 30)	Group B (n = 30)	Test of Sig.	p
Thickness	**At baseline**				
	Min. – Max.	0.46 – 0.75	0.45 – 0.64	U= 315.0	0.070
	Mean ± SD.	0.60 ± 0.09	0.56 ± 0.07		
	Median (IQR)	0.60 (0.52 – 0.65)	0.58(0.49 – 0.60)		
	After one month				
	Min. – Max.	0.36 – 0.60	0.38 – 0.50	U= 325.0	0.064
	Mean ± SD.	0.46 ± 0.07	0.43 ± 0.04		
	Median (IQR)	0.45 (0.39 – 0.51)	0.42 (0.39 – 0.47)		
	Z(p_1)	4.729*(<0.001*)	4.789*(<0.001*)		
Echogenicity	**At baseline**				
	No	0(0.0%)	0(0.0%)	–	–
	Hypoechoic	30(100.0%)	30(100.0%)		
	After one month				
	No	0(0.0%)	0(0.0%)	–	–
	Hypoechoic	30(100.0%)	30(100.0%)		
	^{McN}(p_1)	**–**	**–**		
Bone irregularity	**At baseline**				
	No	12(40.0%)	10(33.3%)	χ^2= 0.287	0.592
	Yes	18(60.0%)	20(66.7%)		
	After one month				
	No	14(46.7%)	12(40.0%)	χ^2= 0.271	0.602
	Yes	16(53.3%)	18(60.0%)		
	^{McN}(p_1)	**0.271(0.500)**	**0.287(0.500)**		
Power dopplar	**At baseline**				
	0	17(56.7%)	14(46.7%)	χ^2= 3.904	^{MC}p= 0.160
	1	12(40.0%)	10(33.3%)		
	2	1(3.3%)	6(20.0%)		
	After one month				
	0	19(63.3%)	26(86.7%)	χ^2= 4.507	^{MC}p= 0.072
	1	10(33.3%)	4(13.3%)		
	2	1(3.3%)	0(0.0%)		
	MH(p_1)	3.0(0.414)	13.0*(<0.001*)		

McN (McNemar-Bowker): MH (Marginal Homogeneity)

- *Tendon thickness significantly improved (decreased) after treatment in both groups.*
- *There is significant difference in power doppler before and after treatment in group B only.*

Table 3. Correlation between tendon thickness and different clinical parameters after treatment

After	Thickness (after)			
	Group A		Group B	
	r_s	p	r_s	p
Visual analog scale	0.593	0.001*	0.405	0.026*
Patient rated tennis Elbow evaluation	0.495	0.005*	0.379*	0.039*
Duration of pain	0.252	0.178	0.025	0.894
Modified mayo clinic index	-0.372	0.043*	-0.395	0.031*
Assessment of tenderness	0.591	0.001*	0.571	0.001*

Decreased tendon thickness has significant positive correlation with (improvement of tenderness, VAS and PRTEE) and negative correlation with modified mayo clinic index after treatment in both groups, while showed no correlation with duration of pain

Table 4. Relation between power dopplar with tenderness, visual analog scale, modified mayo clinic index and PRTEE in group A and group B after treatment

After	Power dopplar			
	Group A		Group B	
	Negative	Positive	Negative	Positive
Visual analog scale				
Min. – Max.	2.0 – 4.0	4.0 – 6.0	2.0 – 5.0	4.0 – 6.0
Mean ± SD.	2.68 ± 0.67	4.91 ± 0.70	3.23 ± 0.82	5.0 ± 1.15
Median	3.0	5.0	3.0	5.0
	3.0*(<0.001*)		10.0*(0.007*)	
Patient rated tennis Elbow evaluation				
Min. – Max.	15.0 – 60.0	25.0 – 65.0	15.0 – 75.0	60.0 – 75.0
Mean ± SD.	41.84 ± 17.26	47.73 ± 13.85	54.42 ± 12.83	67.50 ± 8.66
Median	50.0	50.0	55.0	67.50
	90.0(0.553)		16.0*(0.026*)	
Duration of pain				
Min. – Max.	6.0 – 18.0	9.0 – 240.0	6.0 – 18.0	6.0 – 7.0
Mean ± SD.	9.47 ± 3.56	14.55 ± 6.17	9.81 ± 3.50	6.50 ± 0.58
Median	9.0	12.0	9.0	6.50
	38.0*(0.003*)		14.0*(0.018*)	
Modified mayo clinic index				
Min. – Max.	0.0 – 85.0	50.0 – 80.0	60.0 – 85.0	70.0 – 70.0
Mean ± SD.	70.53 ± 18.77	60.91 ± 9.17	73.08 ± 6.34	70.0 ± 0.0
Median	75.0	60.0	75.0	70.0
	39.0*(0.004*)		26.0(0.123)	
Assessment of tenderness				
Min. – Max.	0.0 – 1.0	1.0 – 2.0	0.0 – 1.0	1.0 – 2.0
Mean ± SD.	0.58 ± 0.51	1.36 ± 0.50	0.69 ± 0.47	1.50 ± 0.58
Median	1.0	1.0	1.0	1.50
	38.50*(0.003*)		18.0*(0.038*)	

There is significant relation between power doppler and duration of pain, improvement of tenderness, VAS and Modified mayo clinic index in group A after treatment.

Cr nv There is significant relation between power doppler and duration of pain, assessment of tenderness, VAS and PRTEE in group B after treatment.

4. DISCUSSION

LE, the most frequently diagnosed disease of the elbow, affects nearly 1% to 3% of the population whose daily activities require strong gripping or repetitive wrist movements. Population between the ages of 35 and 50 years are at higher risk with predominance of the dominant arm [7].

This study included 60 patients, divided into two groups according to the line of treatment; Group I (30 patients) who were treated by Dextrose local injection & group II (30 patients) who were treated by corticosteroid local injection. The injection in both groups were guided by ultrasound.

The age in group I ranged from (31– 56y) with a mean age was (41.90 ± 7.35 y). In group II, the age ranged from (28-55 y) with a mean age was (39.40 ± 8.70 y). There was insignificant difference between both groups as regard the age Table 1. This was agreed with Yadav et al. [8] and Hong et al. [7] who stated that LE occurred among middle aged individuals as it is the age of high manual activities.

Most of our patients in both groups were females; group A included 26 females (86.7 %), while group B included 20 females (66.7%) Table 1.

This was agreed with Wolf et al. [9] in their study of LE, they found that females were more than males and explained this higher risk in females as they tend to have more joint laxity and repetitive overuse than males. Also, Yadav et al. [8] who support a female preponderance in LE. Our results disagreed with Kumar et al. [10] who found that tennis elbow incidence was equal in males and females.

As regard duration of tennis elbow pain, the mean duration of pain was (11.33±5.21) months in group A and (9.37±3.45) months in group B with non-significant difference between both groups before treatment Table 1.

Taylor et al., [11] found that LE tended to be a chronic disease in which prolonged repetitive micro-trauma of the CEO leads to chronic inflammation and tendon degeneration that need long time to recover, also Flatt [12] said that LE is a chronic disease which the pain usually gets worse for several weeks and even months. In our work, there was statistically significant improvement of pain by visual analog scale in group A & group B after treatment with non-significant difference between the two groups after treatment Table 1.

This was agreed with Gautam et al. [13] who found that pain decreased with corticosteroid injection they said that CS injection used to be the treatment of choice for LE as it suppresses the immune system by suppressing the pro-inflammatory proteins and improve pain.

Barnett et al; [14] demonstrated significant improvement in Mayo clinic performance index score with regenerative injection. After 3 months follow up.

Regarding PRTEE questionnaire in our study, there was significant improvement in group A and group B after treatment with significant difference between the two groups after treatment Table 1.

This was agreed with Tang et al. [15] who found significant improvement in the Patient Rated Tennis Elbow Evaluation score during the follow up periods in patients injected with corticosteroids at short term items related to functional improvement.

Yelland et al. [16] and Rabago et al. [17] found that PRTEE score improved after dextrose injection in LE.

Ultrasound evaluation of LE in our study revealed that: Common extensor tendon thickness improved (decreased) in both groups after dextrose and steroid injection with non-significant difference between the two groups Table 2.

Tendon echogenicity and bone irregularity had no significant improvement in both groups after treatment Table 2.

This was agreed with Lee et al. [18] who found that a tendon thickness greater than or equal to 4.2 mm were highly predictive of LE and found that ultrasound examination of common extensor tendon showed a decrease in tendon thickness after corticosteroid injection. They also found that tendon echogenicity and bone irregularity had high specificity but low sensitivity.

This agreed also with Gautam et al., [13] who found that ultrasound examination of common extensor tendon showed decrease tendon thickness after corticosteroid injection.

Ultrasonographic examination in our study revealed that power doppler examination had significant improvement in group B only after treatment with non-significant improvement in group A Table 2.

This agreed with El-Badawy, et al. [19] who found that the post-intervention U/S assessment showed significant decrease in hypoechoic areas and a significant decrease in a disturbed fibrillar pattern when compared to the pre-treatment US assessment. They also showed a significant decrease in Common extensor tendon thickness and found that power doppler signal examination had no significant improvement after dextrose injection.

In our study correlations of ultrasonographic findings in LE (tendon thickness) with clinical and functional parameters (duration of pain, VAS, PRTEE and Mayo clinic performance index and assessment of tenderness). showed significant positive correlations with pain (VAS and tenderness) and functional assessment (PRTEE) with significant negative correlation with Mayo clinic performance index after treatment in both groups with tendon thickness in US, and we found non-significant correlation with pain duration Table 3.

This agreed partially with Clarke et al., [20] who found that there was positive correlation between functional PRTEE and tendon thickness on ultrasonography in LE.

On the other hand this disagreed with Krogh et al., [21] who found that there were no correlations between US changes and Pain and PRTEE.

In our study there was significant relation between power doppler signals on US examination and duration of pain tenderness

improvement, VAS and Modified mayo clinic index in group A after treatment, while there was no significant relation between power doppler and PRTEE in the same group Table 4.

There was significant relation between power doppler on US examination and duration of pain, tenderness improvement, VAS and PRTEE in group B after treatment, while there was no significant relation between power dopplar and Modified mayo clinic index in the same group Table 4.

This was disagreed with Boy et al., [22] who found that ultrasonographic findings did not significantly correlate with duration and severity of the disease clinically. Also, Toit et al., [23] who found that clinical severity measures did not correlate with neovascularity scores.

5. CONCLUSIONS

Dextrose prolotherapy proved to be as effective as corticosteroid in treatment of LE.

Female patient aged 29 years, farmer, complained of LE at the Rt side (dominant hand) for 9 months, injected by dextrose solution twice (group A) under guidance of US and followed up after 1 month from last injection.

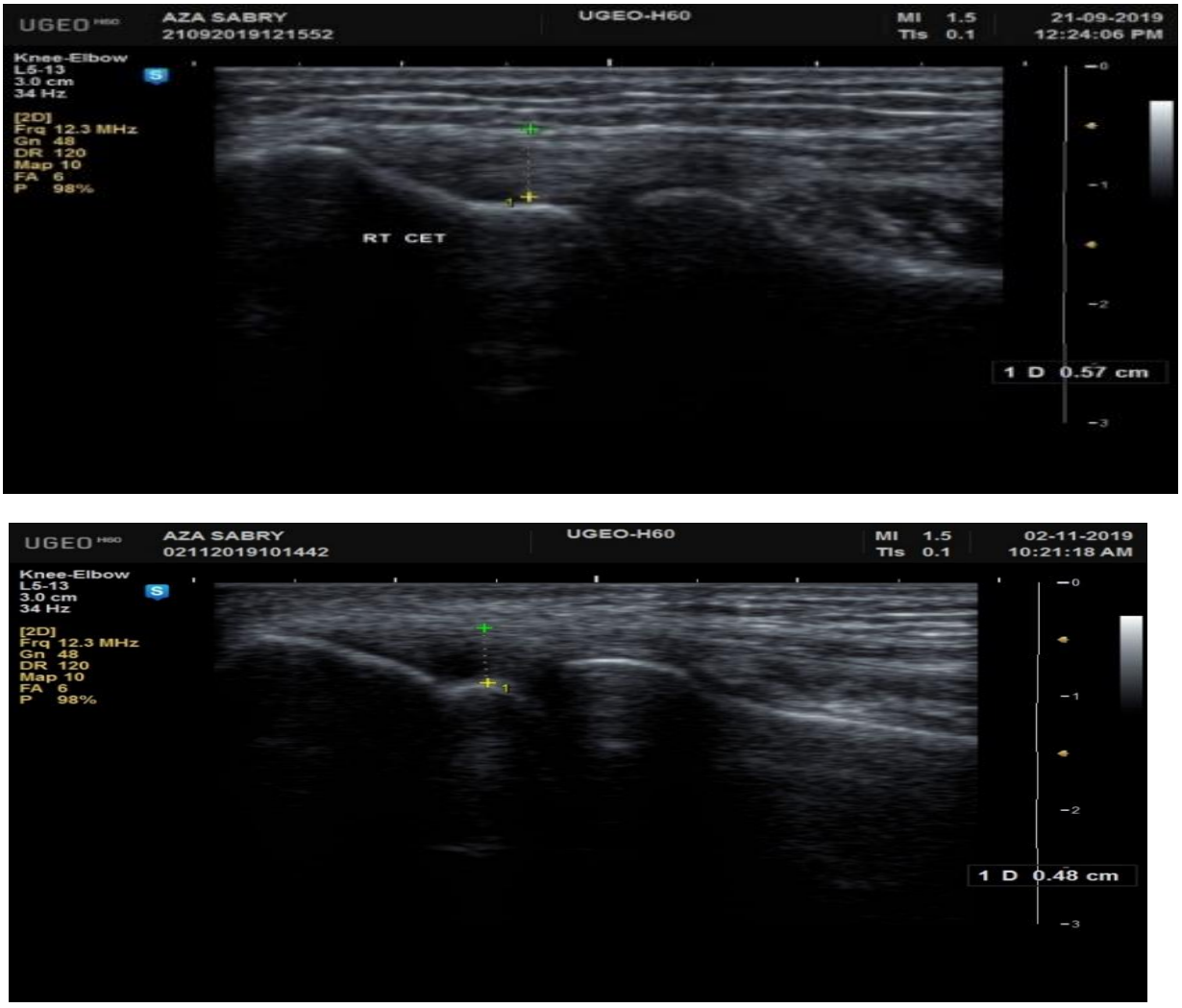

Fig. 1(a). Ultrasonographic examination before treatment showed increased thickness of common extensor tendon (.57cm) at the lateral humeral epicondyle with tendon hypo echogenicity
(b). Ultrasonographic examination after 1 month from last injection by dextrose solution showed decreased thickness of common extensor tendon(.48cm)

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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