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Original Research Article

Evaluation of Clinical Outcome in the Management of Tennis Elbow by Open Surgical Method

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Abstract

Tennis elbow is one of the commonest cause of pain elbow among the labourers, household workers and office staff in India. It is caused by chronic microtrauma induced inflammation and subsequent degeneration of extensor tendons of the wrist, mainly extensor carpi radialis brevis (ECRB). More than 95% respond very well to various conservative and semi invasive methods of treatment. In our study, we are assessing the results of open debridement of extensor carpi radialis brevis in patients who failed to respond to conservative / semi invasive methods of treatment.

Materials and Methods: We have conducted a perspective observational study in our institution from January 1, 2024 to May 31, 2024. Total number of patients -11, Females- 6 (54.5%), Male – 5 (45.5%).

The patients were evaluated at the end of one month, three months and six months and the NIRSCHL score were assessed and the outcome was excellent in 90.9% cases and good in 9.1%. Poor results – zero.

Conclusion: There was significant improvement in pain and muscle strength in patients who had undergone open surgical procedure.

Keywords: Tennis elbow, open surgical procedure, ECRB.

Introduction

Tennis Elbow/ Lateral Epicondylitis (LE) is a chronic aseptic inflammatory condition caused by repetitive microtrauma and excessive load to the common extensors of the wrist, specially to the Extensor Carpi Radialis Brevis (ECRB). It is also known as Periostitis of the Elbow, Tendinitis of ECRB, Lateral Epicondylalgia and Radial Epicondylitis[1]. This disease was described by Runge in 1873.

Pathogenesis

It was thought to be due to a tendinitis following inflammation and was regarded as an overuse injury involving the extensors of the wrist against resistance.

Histologically there is a dense population of fibroblast vascular hyperplasia and disorganized collagen which is termed as angio fibroblastic hyperplasia and is believed to be due to tendon damage by repeated microtrauma. Given the absence of inflammatory changes, it is not clearly known why it should be painful. One of the postulated causes of pain is due to the local hypoxia produced by the repeated injury to the extensor tendon. In response to this hypoxia, cytokines and growth factors are released which will trigger a complex sequential cascade and subsequent neovascularization and poorly organized tendon tissue formation.

Causes

1. Previous trauma or repetitive trauma: sometimes patients may not be aware of the incident. Most produced by repetitive pronation/ supination movements combined with extension of elbows, as seen in racket sport professionals and in jobs requiring frequent elbow movements.
2. As a part of degeneration of tendons: as in Diabetes, Rheumatoid etc.
3. Unknown: it can occur without any recognised repetitive activity. So can be an idiopathic condition.

Symptoms

Develops gradually over months

- **Pain:** most common and often develops slowly, begins as mild and slowly worsens over weeks and months. There may not be a history of specific trauma in most cases. It will

be located in the outer part of the elbow and sometimes maybe more at the joint.

Signs

- Tenderness over lateral epicondyle of elbow is the most common and first developing sign.
- **Cozen's test:** After stabilizing the elbow at 90^0 flexion, palpate the lateral epicondyle. The patient is asked to make a fist, pronate and radially deviate the forearm with extension of elbow against resistance applied by the examiner which will produce increase in pain over the lateral epicondyle. Sensitivity- 91%.
- **Maudsley's test**: It represents the degenerative activity of the origin of the extensor tendon of the wrist. In this test the examiner resists the extension of the third finger of the hand, stressing the extensor digitorum tendon. Positive test indicates pain over lateral epicondyle of the elbow. Sensitivity- 85%
- **Mill's test:** The forearm is passively pronated, and the wrist is flexed and the elbow is extended to the maximum, will produce pain on lateral epicondyle.
- **Grip pain:** Most common functional limitation is grip pain which can be measured as painless grip pain and is reliable and more sensitive than grip strength. This is measured with the patient in supine position with elbow in flexion and forearm in mid prone position and asked to squeeze a dynamometer until the first appearance of pain. Averages of three consecutive readings are taken for data collection.
- **Grip strength** will worsen with increase in pain, measured by squeezing a dynamometer to the maximum. Averages of three consecutive readings are taken for data collection.

Investigations

1. Blood CBC, FBS/PPBS/RFT/LFT/VIRAL MARKERS.

2. X-ray to exclude other pathological causes of elbow. Calcification lateral to the Lateral Epicondyle may be seen in some cases.

3. Ultrasonography: for visualization of extensor muscles, thickening and rupture of extensor tendon.

4. MRI: Most accurate assessment is done by MRI. It will show proximal muscle thickening with increased intensity in T1 and T2 weighted images and may persist for a long time even after successful treatment. Presence of large ruptures, more than 6mm in the tendons or lateral collateral ligament is associated with unsuccessful conservative management.

5. EMG and Cervico Thoracic Spinal Examination is mandatory to rule out the other causes of pain in elbows of spinal origin

It is estimated to affect 1-3% of the population every year in the United States Even though accurate statistics about our nation's disease burden are not available at present, it is a very common condition in all of the Orthopedic OPs in Kerala and Alappuzha is not an exception to it. In comparison with other states of India, Diabetes Melitus is a common medical condition in Kerala and the usual drugs used in the treatment of TE are NSAIDs and local sterinol injections. In patients with DM and TE, both or one of the above drugs are relatively contraindicated for long term use as they may cause poor control of diabetes and subsequent renal failure. Even with the availability of multiple treatment modalities there are no single effective Treatment Procedure available for this disease. So, we have planned to study the effect of an open surgical method in which a failed conservative treatment in tennis elbow occured.

Review of Literature: One of the most common causes of elbow pain, usually affects the dominant upper limb in the active age group i.e, 25 to 55 years, 1-3% of the common population is affected. In Indian conditions the people commonly affected are mechanics, artists, electricians and homemakers who require frequent repetitive moments on elbows for their daily activities.

As per Sanders et.al.[2] it is common among many office workers, secretaries and medical staff. In sports it is common in racket professionals who constantly overload their elbows, such as tennis, badminton, squash, gymnastics, acrobatics and weightlifting. Tennis elbow is a leading cause of loss of work hours and subsequently causes a significant dent to the economy of our nation.

Treatment

I) Conservative: Includes rest, NSAIDS, analgesics, cortico steroids, cryotherapy, acupuncture, physiotherapy, ultrasound, laser, manual mobilization, shock waves and epicondylar strengthening and stretching exercises, epicondylar braces [3] etc. In different studies it has shown that the systemic/ topical NSAID will improve the pain symptom not the arm function compared with placebo. Local steroid injection has reported positive effects on both the pain and Arm function.

Local anesthetic injection: when compared with the steroid it has equal effects of steroid. [4]

II) Autologous Blood: Creaney et.al. [5] reported that growth factors from blood improves the healing process of the muscles in skeletal injuries in sports medicine. Mechanism of action is by stimulating inflammation and subsequent healing.

III) Physiotherapy and Other Modalities: Physiotherapy and kinetic therapy are used widely in the treatment of TE. Their usefulness ranges from acute phase of the disease to rehabilitation.

They help to preserve

1. Joint movements
2. Maintain the strength of muscles
3. Prevention of contractures

Different combinations of Physiotherapy are used in different stages of disease.

Manual therapy of elbow and wrist are useful in the rehabilitation phase after some interventional procedures. It will speed up the recovery. [6]

Orthosis: a variety of different orthopedic orthotics are being used. Overall, their usefulness is highly controversial. They are helpful in pain relief and improving arm function. [7]

Acupuncture and lasers are also used with a short-term relief.

IV) Percutaneous Techniques

Platelet Rich Plasma Injection (PRP): PRP is made by using the patient's own blood. It is widely used in Orthopedics and sports medicine for the treatment of soft tissue injuries or surgical interventions.It is a potential treatment option in patients in case of failed physiotherapy. [8]

Mishra et al. [9] reported results of PRP in LE patients in his prospective cohort study of 230 patients who failed to respond to conservative treatment and underwent PRP injection showed a significant improvement in the pain compared to the control group. 71.5% v/s 56.1% P = 0.019 with significant lowering of residual sensitivity.

B. Percutaneous Multiple Puncturing with Needle: In 1962 Loose performed the first successful percutaneous lateral condyle release with local anesthesia. It was also reported by other authors[10-13]. This is done as a minimally invasive procedure and is a day care procedure too.

V) Surgical Treatment

In this mode of management debridement of extensor carpi radialis brevis [ECRB] and decortication of the lateral epicondyle is done.

Surgical Release: Usually, most patients respond to conservative treatment. Nonetheless, in some patients, the symptoms persist for a long time despite treatment. In such cases, a surgical approach is indicated. There are many surgical techniques, most of them include debridement of the affected tendon of the m. ECRB and decortication of the lateral epicondyle. Surgery can be performed using open, percutaneous, or arthroscopic techniques.[14 15 16] Scheme presenting the open release of lateral epicondylitis. Under general or regional anaesthesia, skin incision- curvilinear over the lateral epicondyle; The Extensor carpi radialis longus – extensor digitorum communis interface is identified. Degenerated tissue at extensor carpi radialis brevis muscle is identified and incised, and decortication of lateral epicondyle is done with an osteotome. Wound is closed in layers and sterile dressings are applied. Sutures were removed after 12 days.

Nirschl Scoring System for Assessment of Tennis Elbow [17]

Pain Score

Table 1: Pain Score

Pain score	Total 40
At rest	10
On stretching	10
Pressure Pain	10
Chair test	10

Table 2: Functional Score

Functional score	Total 30
Pain at rest	10
Pai at ADL	10
Pain at night	10

Table 3: Strength Score

Strength score	Total 20
Grip strength	10
Flexion extension strength	10

Range of elbow motion- 10
Total score = 100

Post procedure score greater than 80- excellent
>60 - good
>50 - fair
<50- poor [17]

Evaluation: The outcomes are going to be assessed by the same hands which had performed the above-mentioned procedures. Assessment will be done at the base line (i.e. pretreatment) 1,3,6,9,12 months after the procedure.

Materials and Method

- **Study design**: Prospective Observational study.
- **Study duration:** 1 year after the clearance from institutional ethics committee clearance.
- **Study setting**: Govt. TD Medical College Alappuzha.
- **Sampling method:** Consecutive Sampling
- **Study variables:**

Patient related

1. Age
2. gender
3. co-morbid conditions
4. occupation
5. Single/double joints
6. work involved

Assessment variables

1. Post op condition
- Pain score
- Function
- Range of movements
- Patient satisfaction at 3 months

2. Post procedure infection
3. Recurrent procedure

Sample size calculation

The percentage of people required surgical correction is from 1%- 3% [18]

Sample size is calculated using the formula with the help of N Master software

$$n= Z^2_{(1-\alpha/2)} P(1-P)/d2$$

The sample size was adjusted for finite population given by

$$N_{Finite} = F X n$$

Where F=1/ 1+ n/population
P= Expected population taken as 97%
d = Absolute precision given as 5%
1-α /2 = desired confidence level 95%
N =population size taken as 10

Applying all the values in the equation the final sample size obtained as 8

Samples are calculated from patients with Tennis Elbow in the orthopedic OPD of Govt. T D Medical College Alappuzha during the study period who are willing to undergo the said procedures.

Study population: All patients with Tennis Elbow admitted in the orthopedic OP of Govt. T D Medical College Alappuzha during the study period who are willing to undergo the said procedures.

Inclusion and Exclusion Criterias

Inclusion criterias

- Pain resistant to 3 conservative non operative methods and presence of continuous symptoms for at least last 3 months with no or minimal relief.
- Persons with age more than 18 years

Exclusion criterias

- Local infection
- Previous major trauma/ surgery to elbow
- Local steroid injection within 1 month of the surgery
- Not willing to give consent for surgery, study and proper followup.

Assessment

- **Early at the End of Third Month**

Pain: assessed using Visual Analogue scale (VAS).

1. Tenderness in response to maximum pressure by the examiner's thumb to the lateral epicondyle (VAS 1-10). Patient sitting in a chair with elbow 90^0 flexion and forearm in neutral position.
2. Grip pain measured using a dynamometer. Readings are taken at the starting of pain and an average of three consecutive values are taken.
3. Grip Strength of both hands using a dynamometer is measured. The maximum pressure that can be exerted in a dynamometer is measured. Average is taken of three consecutive values.

Successful treatment is determined as a reduction of greater than 25% - 50% baseline pain VAS score and 25%- 50% increase in the grip strength.

- **After Six, Nine and Twelve Months**

Evaluation is done by assessing the Functional and NIRSCHL Score. The Functional outcomes are

1. Pain
2. Function
3. Patient satisfaction
4. Range of movement

Complete remission of TE is considered when pain VAS score- 0 at 12 months.

Grip strength >90% of that of the opposite limp.

Results

Table 4:

Occupation	Frequency	Percentage
Housewife	4	36.4
Manual labour	1	9.1
Painter	1	9.1
Tailor	2	18.2
Workshop	3	27.3
Total	11	100.0

The above table shows that 36.4% of patients were housewives, 27.3% were working in a workshops, 18.2% were tailors and 9.1% were manual labours and painters.

Table 5:

Age Group	Frequency	Percentage
30-45 years	7	63.6
46-60 years	4	36.4
Total	11	100.0

About 63.6% of patients belonged to the age group of 30-45 years, and 36.4% belonged to 46-60 years.

The mean age was 42.818 ± 6.968. The minimum age was 33, and the maximum age was 56.

Table 6:

Gender	Frequency	Percentage
Female	6	54.5
Male	5	45.5
Total	11	100.0

Among them, 54.5% were females and 45.5% were males.

Table 7:

Side	Frequency	Percentage
Left	2	18.2
Right	9	81.8
Total	11	100.0

Majority (81.8%) had problem in the right side of elbow.

Table 8:

Rest Pain	Frequency	Percentage
Absent	1	9.1
Present	10	90.9
Total	11	100.0

Rest pain was present in 90.9% patients.

Night pain was present in 100% patients.

Table 9:

Diabetes	Frequency	Percentage
Absent	7	63.6
Present	4	36.4
Total	11	100.0

Diabetes was present in 36.4% of patients.

Table 10:

Hypothyroid	Frequency	Percentage
Present	6	54.5
Absent	5	45.5
Total	11	100.0

Hypothyroidism was present in 54.5% of patients.

Table 11:

Addiction	Frequency	Percentage
Alcohol	5	45.5
Nil	6	54.5
Total	11	100.0

Majority (54.5%) had no addiction, 45.5% had addiction to alcohol.

Preop Cozen, Mill's, Maudsley's test were positive in all patients.

1 mon

Table 12:

Cozen's Test	Frequency	Percentage
Negative	1	9.1
Positive	10	90.9
Total	11	100.0

Post operation 90% showed positive Cozen's test at 1 month. Mill's and Maudsley's test were positive in all patients.

3 mon

Table 13:

Cozen's Test	Frequency	Percentage
Negative	10	90.9
Positive	1	9.1
Total	11	100.0

Cozen's test was negative in 90.3% patients after 3 months of procedure.

Table 14:

Mill's Test	Frequency	Percentage
Negative	9	81.8
Positive	2	18.2
Total	11	100.0

Mill's test was negative in 81.8% patients after 3 months.

Table 15:

Maudsley's Test	Frequency	Percentage
Negative	2	18.2
Positive	9	81.8
Total	11	100.0

Maudsley's test was positive in 81.8% patients after 3 months.

6 mon

Cozen's test and Mill's test was negative in 100% of patients after 6 months.

Table 16:

Maudsley's Test	Frequency	Percentage
Negative	7	63.6
Positive	4	36.4
Total	11	100.0

Maudsley's test was negative in 63.6% patients after 6 months.

NIRSCHL score was poor in 100% patients before the procedure.

Table 17:

NIRSCHL Score @ 1 month	Frequency	Percentage
Poor	3	27.3
Fair	4	36.4
Good	4	36.4
Total	11	100.0

NIRSCHL score was poor in 27.3% of patients, fair and good in 36.4% of patients after 1 month.

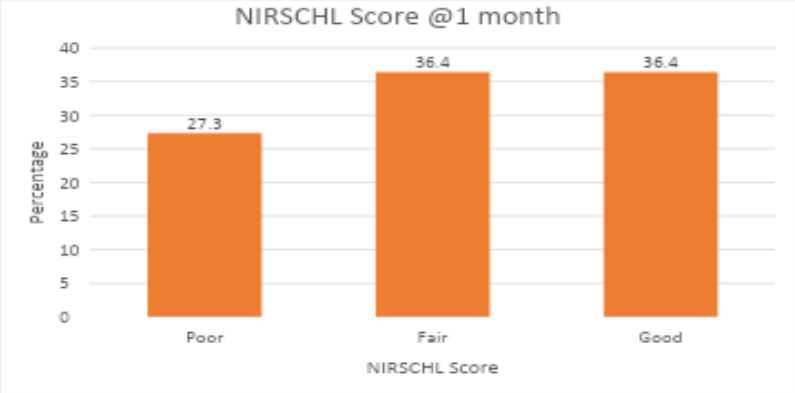

Figure 1: NIRSCHL Score @ 1 month

Table 18:

NIRSCHL Score @ 3 months	Frequency	Percentage
Fair	1	9.1
Good	6	54.5
Excellent	4	36.4
Total	11	100.0

NIRSCL Score was excellent in 36.4%, good in 54.5% and fair in 9.1% of patients after 3 months.

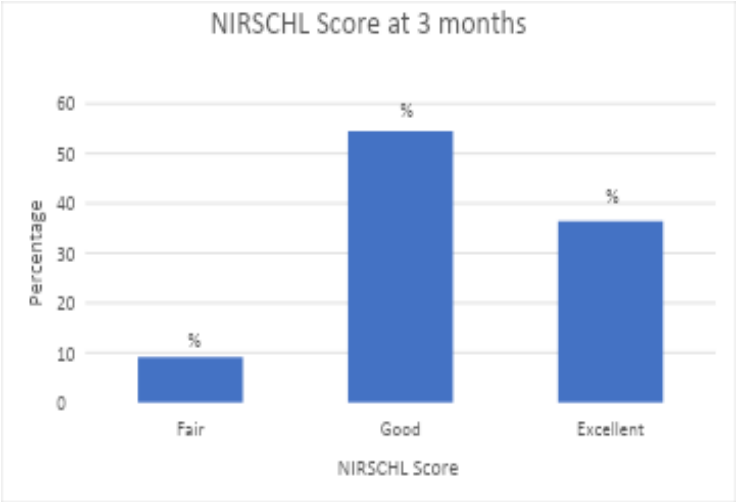

Figure 2: NIRSCHL Score @ 3 month

Table 19:

NIRSCHL Score @ 6 months	Frequency	Percentage
Good	1	9.1
Excellent	10	90.9
Total	11	100.0

NIRSCHL Score was excellent in 90.9% and good in 9.1% of patients after 6 months.

Table 20:

NIRSCHL Score	N	Mean	Std. Deviation	Mean Rank	Friedman Test (value)	P value	Significance
Preop	11	25.455	7.8021	1.00	33	<0.001	Significant
1 month	11	54.455	12.7622	2.00			
3 months	11	75.364	8.5706	3.00			
6 months	11	89.636	6.6974	4.00			

P value <0.05 (Significant): The above table shows that there is a significant difference in improvement of score on follow up through preop, 1 month, 3 months and 6 months after the procedure. We rejected the null hypothesis of the Shapiro-Wilk test for all groups and dimensions, indicating a non-normal data distribution, likely due to small sample sizes. We chose the Friedman

Test for those comparisons due to its suitability for non-normally distributed data.

Table 21:

Nirschl Score	Mean	N	Std. Deviation	Paired differences	T Value	P value	Significance
Preop	25.455	11	7.8021	29±8.775	10.961	<0.001	Significant
Postop at 1 month	54.455	11	12.7622				

As the data is normally distributed, paired t-test was applied and a significant difference was found between preop and postop procedure after 1 month.

Table 22:

Pain Score	N	Mean	Std. Deviation	Mean Rank	Friedman Test (value)	P value	Significance
Preop	11	10.000	.0000	4.00	32.725	<0.001	**Significant**
1 month	11	5.364	1.5015	3.00			
3 months	11	2.182	.9816	1.95			
6 months	11	.727	.6467	1.05			

The above table shows that there is a significant decrease in pain score on follow up through preop, 1 month, 3 months and 6 months after the procedure.

Table 23:

Grip Strength	N	Mean	Std. Deviation	Mean Rank	Friedman Test (value)	P value	Significance
1 month	11	56.364	9.2442	1.09	16.545	<0.001	Significant
3 months	11	72.727	8.7646	2.09			
6 months	11	84.818	12.4645	2.82			

The above table shows that there is a significant difference in improvement of grip strength on follow up through 1 month, 3 months, and 6 months after the procedure.

Table 24:

Flexion movement	N	Mean	Std. Deviation	Mean Rank	Friedman Test (value)	P value	Significance
Preop	11	118.182	11.6775	1.00	32.725	<0.001	Significant
1 month	11	128.636	9.7701	2.00			
3 months	11	140.909	6.6401	3.05			
6 months	11	147.273	3.4378	3.95			

The above table shows that there is a significant difference in improvement in movement on follow-up through preop, 1 month, 3 months, and 6 months after the procedure.

Table 25:

Diabetes	NIRSCHL Score		Total
	Good	Excellent	
No	0(0%)	7(100%)	7(100%)
Yes	1(25%)	3(75%)	4(100%)
Total	1(9.1%)	10(90.9%)	11(100%)

Chi-square value-1.925, P value (Fisher's Exact test)- 0.364

After the procedure at 6 months, 75% of diabetic patients had excellent results. Among non-diabetics, 100% had excellent results. But there was no significant difference in results between diabetic and non-diabetic patients based on NIRSCHL Score.

Table 26:

Hypothyroid	NIRSCHL Score		Total
	Good	Excellent	
No	0(0%)	6(100%)	6(100%)
Yes	1(20%)	4(80%)	5(100%)
Total	1(9.1%)	10(90.9%)	11(100%)

Chi-square value-1.32, P value (Fisher's Exact test)- 0.455

After the procedure at 6 months, 80% of hypothyroid patients had excellent results. Among non-hypothyroid, 100% had excellent results. There was no significant difference in results between hypothyroid and non-hypothyroid patients based on NIRSCHL Score after the procedure.

Discussion

According to the current study majority of patients had excellent to good results following the procedure based on NIRSCHL score.

The mean age was 42.818 ± 6.968. The minimum age was 33, and the maximum age was 56. Among them, 6 (54.5%) were females and 5 (45.5%) were males. Similarly, a study conducted by Nazar M et.al. showed that the mean age at the time of operation was 53 years with a range of 26 to 71 years. There were 7 male and 17 female patients in this series. [10]

Among them 4 (36.4%) patients were housewives, 27.3% were working in a workshop, 18.2% were tailors and 9.1% were manual labourers and painters. According to the study by Cho BK et al. 17 were housewives, 21 were labourers, 2 were involved in sports activities, and 2 were office workers out of 41 patients. [13] Majority (81.8%) had problem in the right side of the elbow in present study. Similarly in the study by Sanders TL Jr et al. the right elbow was more likely to be affected than the left elbow (63% vs 25%), and 12% of patients had both elbows affected. [2]

NIRSCHL Score was excellent in 90.9% and good in 9.1% of patients after 6 months. According to the study by Kaleli T et.al. 24 patients were rated as having excellent results. One patient was rated as having a good result and one who was rated as having a poor result underwent a second operation. [12] Similarly in the study conducted by Nazar M et. al. showed that the post-operative outcome was good to excellent in most patients. Eighty seven percent of patients had complete pain relief. [10]

Maudsley's test was negative in 7 patients (63.6%) patients after 6 months of surgery in the present study. The preoperative Roles & Maudsley score was acceptable in 6 cases, and poor in 36 cases, which was changed to excellent in 23 cases, good in 16 cases, acceptable in 3 cases after surgery according to the study by Cho BK et al.[13] There was a significant decrease in mean pain score on follow up through preop [10], 1 month, 3 months and 6 months (0.727) after the procedure ($p = <0.001$). According to the study by Cho BK et al. the mean VAS score for pain at rest improved from 5.36 (range, 3 to 7) preoperatively to 0.3 (Range, 0 to 2) at the last follow-up ($p = 0.007$). [13] There was a significant difference in improvement in movement on follow-up through preop, 1 month, 3 months, and 6 months after the procedure in the present study. In the study conducted by Dunn JH showed that 92% of the patients reported normal elbow range of motion. The overall improvement rate was 97%. [17] There were no complications following the procedure in our study. According to the study by Cho BK et al. The postoperative complications encountered included two cases of subcutaneous seroma due to the leakage of joint fluid and one case of continuous pain. The former two cases, which were noticed after the skin suture was removed, were managed with revision under local anaesthesia. [13]

Weakness of Study

1. Small sample size
2. Short duration of follow up.

Ethical Considerations

After obtaining clearance from the research council, the protocol will be submitted for clearance from the ethical committee. Prior approval needs to be obtained from the ethics committee of our institute and a written informed consent from all the patients in their mother tongue. Participant information sheets will be given to all the study subjects in their native language informing them about the procedure involved, also making them aware that they can withdraw from the study any time they want and that this study would in no way influence their management in the hospital in a negative way. No financial assistance was received for the above studies from any agencies or persons.

Conclusion

There were significant symptomatic and functional improvement in elbow pain in patients with tennis elbow (resistant to conservative / semi open procedures) who had undergone open surgical procedure at the end of six months. So we conclude that open surgical procedure is a simple and excellent procedure of choice in patients with resistant tennis elbow.

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