"ANALYSIS OF FUNCTIONAL OUTCOME OF SINGLE DOSE INTRA LESIONAL PLATELET RICH PLASMA INJECTION VERSUS SINGLE DOSE CORTICOSTEROID INJECTION IN THE TREATMENT OF CHRONIC LATERAL EPICONDYLITIS – A PROSPECTIVE COMPARATIVE STUDY"

BY

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DISSERTATION SUBMITTED TO SRI DEVARAJ URS ACADEMY OF

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IN

ORTHOPAEDICS

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Abstract

Introduction

PRP produces high quantities of platelet derived growth factor which aid in tendon healing by promoting angiogenesis and the synthesis of collagen. PRP is the optimal biological blood-derived autologous product. Current study assess the treatment efficacy of PRP vs CS in individuals with LE.

Material and methods: Prospective randomized control parallel group comparative study done with 54 patients. PRP and corticosteroids were compared for efficacy in cohort of 27 individuals each. Using block randomization technique, the participants are allotted into two treatment groups, single PRP dose and single CS dose. Quick-Dash, Oxford Elbow, Mayo Elbow Score, etc. were considered as primary outcome variable. Treatment (CS/ PRP) was considered as primary explanatory variable. Age, gender, side, diagnosis etc. were considered as the study relevant variables. Statistical significance was regarded as a P value <0.05. Statistical evaluation was performed using IBM SPSS version 24.

Results: Difference in proportion age, gender, effected side and co-morbidities between two study groups was statistically insignificant. Pre-injection to 6 months' time VAS score was reduced in both treatment groups, but PRP group had better resolution of pain compared to the CS group. The difference in the Quick-DASH and 6 months follow ups on CS and PRP was statistically significant with values 0.420 and 0.170 respectively, though the PRP group had better score 17 compared to CS group 19. Oxford Elbow score was 64 for CS group at pre-injection but at six month follow up they recovered than the PRP group who had only 60 to begin with but had [illegible] score of 93, which is graded excellent. The PRP

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LIST OF ABBREVIATIONS

S. NO	Abbreviations	Explanation
1	AWB	Autologous whole blood
2	BMI	Body mass index
3	CE	Conformite europeenne
4	CGRP	Calcitonin gene-related peptide
5	CS	Corticosteroid
6	DASH	Disabilities of the Arm, Shoulder and Hand
7	ECRB	Extensor carpi radialis brevis
8	EGF	Epidermal growth factor
9	IQR	Interquartile range
10	LCL	Lateral collateral ligament
11	LE	Lateral epicondylitis
12	MCL	Medial collateral ligament
13	MEPI	Mayo Elbow Performance index
14	NS	NIRSCHL staging
15	NSAID	Nonsteroidal anti-inflammatory drug
16	OD	Open debridement
17	PLRI	Posterolateral rotatory instability
18	PPP	Platelet-poor plasma
19	PPT	Pressure pain threshold
20	PRP	Platelet-rich plasma
21	PRTEE	Patient rated tennis elbow evaluation
22	RCT	Randomized controlled trials
23	RR	Relative risk
24	SMD	Standardized mean difference
25	SP	Substance P
26	TGF-1	Transforming growth factor-1
27	UGPT	Ultrasound-guided percutaneous

28	UMD	Unstandardized mean differences
29	US	Ultrasonography
30	VAS	Visual analog score
31	VEGF	Vascular endothelial growth factor
32	IL	Intra lesional
33	IL-1	Interleukin-1
34	MRI	Magnetic resonance imaging
35	PDGF	Platelet derived growth factor
36	IGF-1	Insulin like growth factor-1
37	DEPA	Dose, Efficiency, Purity, Activation
38	EDTA	Ethylenediaminetetraacetate
39	RPM	Revolutions per minute
40	SD	Standard deviation
41	HTN	Hypertension
42	DM	Diabetes Mellitus

ABSTRACT

Introduction: PRP produces high quantities of platelet derived growth factor which aid in tendon healing by promoting angiogenesis and the synthesis of collagen. PRP is the optimal biological blood-derived autologous product. Current study assess the treatment efficacy of PRP vs CS in individuals with LE.

Aims and objective:

- To determine efficacy of single dose IL-PRP injection in lateral epicondylitis based on the functional outcome with the Oxford elbow score, Quick DASH score, modified Mayo Elbow Performance index (MEPI) for elbow and pain by Visual Analogue Pain scale (VAS) at end of 1st month, 3rd and 6th months.
- To determine efficacy of single IL-CS in lateral epicondylitis based on the functional outcome with the Oxford elbow score, Quick DASH score, MEPI for elbow and pain by VAS at end of 1st month, 3rd and 6th month.
- To compare the efficacy of single dose IL-PRP with single dose IL-CS injection in chronic lateral epicondylitis.

Material and methods: Prospective randomized control parallel group comparative study done with 54 patients. PRP and corticosteroids were compared for efficacy in cohort of 27 individuals each. Using block randomization technique, the participants are allotted into two treatment groups, single PRP dose and single CS dose. Quick-Dash, Oxford Elbow**,** Mayo Elbow Score, etc. were considered as primary outcome variable. Treatment (CS/ PRP) was considered as primary explanatory variable. Age, gender, side, diagnosis etc. were considered as the study relevant variables. P value <0.05 was considered as statistically significant. IBM SPSS version 24 was used for statistical analysis.

Results: Difference in proportion of age, gender, effected side and co-morbidities between two study groups was statistically insignificant. Pre-injection to 6 months' time VAS score was reduced in both treatment groups but the PRP group had better resolution of pain compared to the CS group. The difference in the Quick-Dash at 1 and 6 months follow ups between CS and PRP was statistically insignificant with p values 0.4204, 0.1170 respectively, though the PRP group had a better score of 17 compared to the CS group with 22. Oxford Elbow score was 64 for CS group at pre -injection but at six-month follow up they scored less than the PRP group who had only 60 to begin with but had great improvement by the end of six months with score of 93, which is graded excellent. The PRP group started with score 65 pre- injection and had excellent improvement at the six-month follow score of 95. The CS group started with slightly lesser score of 64 and reached to score of 83 at six-month follow-up, which is graded as fair on the Mayo Elbow score.

Conclusions: There was excellent improvement with PRP treatment compared to the CS at the six-month follow up in VAS, Quick-Dash, Oxford and Mayo Elbow Scores.

Key words: Lateral Epicondylitis/Tennis Elbow, Platelet Rich Plasma (PRP) injection, Corticosteroid (CS) injection, Intra Lesional (IL), Quick-Dash, Oxford and Mayo Elbow Score.

INTRODUCTION

INTRODUCTION

Chronic pain at origin of common extensor over the lateral portion of elbow is the hallmark of lateral epicondylitis (LE). Runge initially noted it in 1873, saying that it frequently affected women in their fifth and sixth decades.[1] Although it might not always be related to playing tennis, it is frequently observed in those who engage in repetitive forearm and elbow extension movements, such as carpenters, musicians, or computer programmers.[2] Wrist extensor tendons' attachment to the lateral epicondyle of humerus was implicated in the chronic symptomatic degeneration of those tendons. Between 1% and 3% of the population are affected by this widespread illness, which typically affects middle-aged people without a gender preference.[3] The muscle that is frequently involved is extensor carpi radialis brevis (ECRB), which was first identified by Cyriax. Tendinitis, an inflammation of the tendon, was once assumed to be the pathophysiology of lateral epicondylitis. Histopathological analysis has shown that it lacks inflammatory cells like neutrophils and macrophages. As a result, condition is considered a form of tendinosis, which is a degenerative process.[4]

Despite its relatively high prevalence, there is no one efficient and reliable management algorithm. M majority of instances are self-limiting and effectively treated with basic painkillers, with 90% of patients healing within a year. Patients who have significant or ongoing symptoms may benefit from further conservative or surgical alternatives for treatment.[4] Rest, nonsteroidal anti-inflammatory drugs, painkillers, braces, physical therapy, extracorporeal shock wave therapy, and injections of botulinum toxin are all used to treat LE. Corticosteroid injections, which were once considered as gold standard are now a controversy statement, platelet-rich plasma (PRP), whole blood, and various surgical procedures have also been recommended.

Since 1950s, injection corticosteroids have been utilized, and for many years, this has been the preferred method of treatment. However, numerous trials have found no sustained positive effect; hence, a number of substitute biologic injectable therapy are now accessible.

Although it has been demonstrated that corticosteroid injections provide effective short period pain relief, their long period effect may actually be tendon degeneration. Six months after receiving a corticosteroid injection, Gautam et al. assessed the common extensor origin using ultrasound and discovered that the tendon's thickness had decreased and cortical erosions in the lateral epicondyle had risen, suggesting progressive degeneration.[5] The process of recovering from injuries to human musculoskeletal system is complicated and influenced by a variety of variables. Growth factors that are stored in granules of platelets and produced at site of injury play a significant role in regeneration process at cellular level. The development of methods for making platelet-rich concentrates as a result of research on the biological potential of platelets has contributed to the advancement in field of regenerative medicine.[6] In an effort to promote quick recovery, advanced growth factor preparations made from patient's own (autologous) blood are employed to drive the body's natural tissue-healing processes. Platelet-rich plasma (PRP) injection and autologous whole blood (AWB) are the preparations that have been discussed the most in the literature. Numerous randomized controlled experiments have compared the effects of AB with PRP injection, AB with steroid injection, and PRP with steroid injection (RCTs). Results on which treatment is more advantageous PRP, AB, or corticosteroids are still unknown.[7]

Currently, lateral epicondylitis (tennis elbow) and other enthesopathies, including intricate and challenging-to-heal in bone union, are treated using autologous PRP preparations.[8,9] Eight distinct injectable therapy were identified by network meta-analysis in previous systematic reviews by Krogh et al., which included 17 trials. There were no trials that compared the efficacy of AB, PRP, and corticosteroids to AB and PRP, respectively, but the results showed

that they were all more effective than a placebo [measured by standardized mean difference (SMD)].[6]

Short-term results of local corticosteroid injections for lateral elbow epicondylitis were better than those of local PRP therapies (4 weeks and 8 weeks post-treatment). Pain and function were better managed with PRP injections than with corticosteroid injections during the 24-week follow-up after therapy.[10] In a systematic review of five RCTs, CS injections were found to provide rapid symptomatic improvement, reaching its peak effect at 6/8/18 weeks before symptoms returned, while PRP showed slower ongoing improvements up to 24/52/104 weeks in three RCTs. One RCT also revealed that CS provided faster symptomatic improvement than PRP up to study's endpoint of 3 months. In one trial, the therapeutic effects of corticosteroid and PRP were comparable at 6 weeks.[11]

Only one of the three studies found a clinically meaningful difference between PRP and injection corticosteroid in terms of pain and Disabilities of the Arm, Shoulder, and Hand (DASH) score. Ahmad et al. also discovered that PRP was superior to blood injection in terms of non response rate, surgical conversion rate, and pain visual analog score (VAS). To conduct a network meta-analysis, these meta-analyses lacked the necessary methodological quality and instead used standardized mean differences. To pool the results, they included few trials as well. Sources of heterogeneity (age, gender, duration of disease, intervention preparation, and outcome period assess) as well as the heterogeneity itself were not evaluated. In addition, after this study was conducted, further RCTs have been published.[7]

OBJECTIVES

NEED OF THE STUDY

There is considerable debate concerning the clinical effects of using platelet-rich plasma (PRP), autologous blood (AB), and corticosteroid injection in lateral epicondylitis. The present study was conducted to analysis the functional outcome of single dose intra lesional PRP injection versus single dose intra lesional corticosteroid injection in treatment of chronic lateral epicondylitis.

REVIEW OF LITERATURE

OBJECTIVES OF THE STUDY

- To determine efficacy of single dose IL-PRP injection in lateral epicondylitis based on the functional outcome with the Oxford elbow score, Quick DASH score, modified Mayo Elbow Performance index (MEPI)for elbow and pain by Visual Analogue Pain scale (VAS) at end of 1st month, 3rd and 6th months.
- To determine efficacy of single IL-CS in lateral epicondylitis based on the functional outcome with the Oxford elbow score, Quick DASH score, MEPI for elbow and pain by VAS at end of 1st month, 3rd and 6th months.
- To compare the efficacy of single dose IL-PRP with single dose IL-CS injection in chronic lateral epicondylitis.

REVIEW OF LITERATURE

Epicondylitis

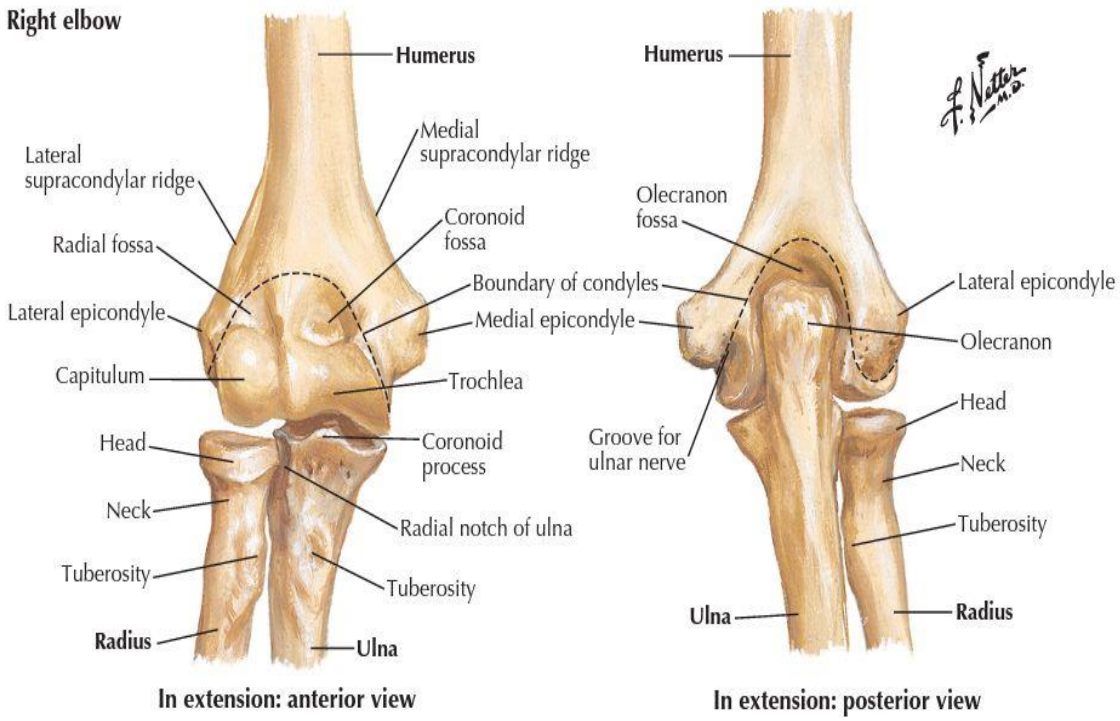
Epicondylitis is a degenerative condition affecting flexor-pronator muscle group at medial elbow and lateral elbow's origin of extensor tendons. It is believed that overuse and the repetitive stress cause tendinosis, which develops into partial tearing and microtrauma before progressing into full-thickness tendon rupture. The upper extremity frequently affects from lateral and medial epicondylitis. Epicondylitis is a painful condition that impairs function and is frequently brought on by particular sports- and work-related activities.[2,12]

Epicondylitis was first thought to be an inflammatory condition, but in 1979, it was identified as the result of invasion of fibroblasts that disrupted the normal collagen architecture together with an immature vascular reparative response known as "angiofibroblastic hyperplasia."[13]

Relevant surgical anatomy and physiology

The shoulder and elbow joint work together to precisely place the hand in space. Along medial and lateral supracondylar ridges and to each epicondyle, distal humeral shaft flares laterally and medially. Medial epicondyle serves as origin of medial collateral ligament complex and flexor-pronator muscles of forearm. Lateral epicondyle, together with lateral supracondylar ridge, acts as origin of extensor-supinator muscle group, and is where lateral collateral ligament complex is attached.[14]

Figure 1: Elbow joint. Netter. Atlas of Human Anatomy [15]



Elbow is synovial type of joint that permits substantial extension and flexion of the forearm as well as mobility of hand through supination and pronation of forearm. Majority of the stability of elbow joint is provided by osseous articulations of the ulnar olecranon and trochlea of humerus. Trochlear notch, a landmark that fits around trochlea of humerus and acts as main pivot point during elbow flexion and extension and is positioned on the scoop- or wrench-shaped olecranon. With a central groove and a large trochlea, the humerus's trochlea allows for tight fitting of two structures, enhancing stability. Trochlear notch spans roughly 180 degrees around the humerus. Medial and lateral collateral ligament (MCL & LCL) which are two powerful ligaments, supply remainder of major stability components of the elbow joint after osseous articulations of humerus and ulna (ulnohumeral articulation). LCL and MCL work together to create joint capsule, adding to its stability.[16]

LCL is made of annular ligament, lateral radial collateral ligament, and lateral ulnar collateral ligament. Three LCL parts offer posterolateral rotational stability as well as

stability under varus loads on the elbow. Lateral ulnar collateral ligament is primary stabilizer in posterolateral rotational structure as it crosses over inferior aspect of radial head, emerging from lateral epicondyle of humerus and inserting at supinator crest of ulna. Annular ligament, which originates and inserts at sigmoid notch of ulna and wraps around neck of radius, stabilize proximal radioulnar joint.[16]

Figure 2: Synovial membrane of elbow joint (anterior view). Gray's Anatomy for Students 2ed.[17]

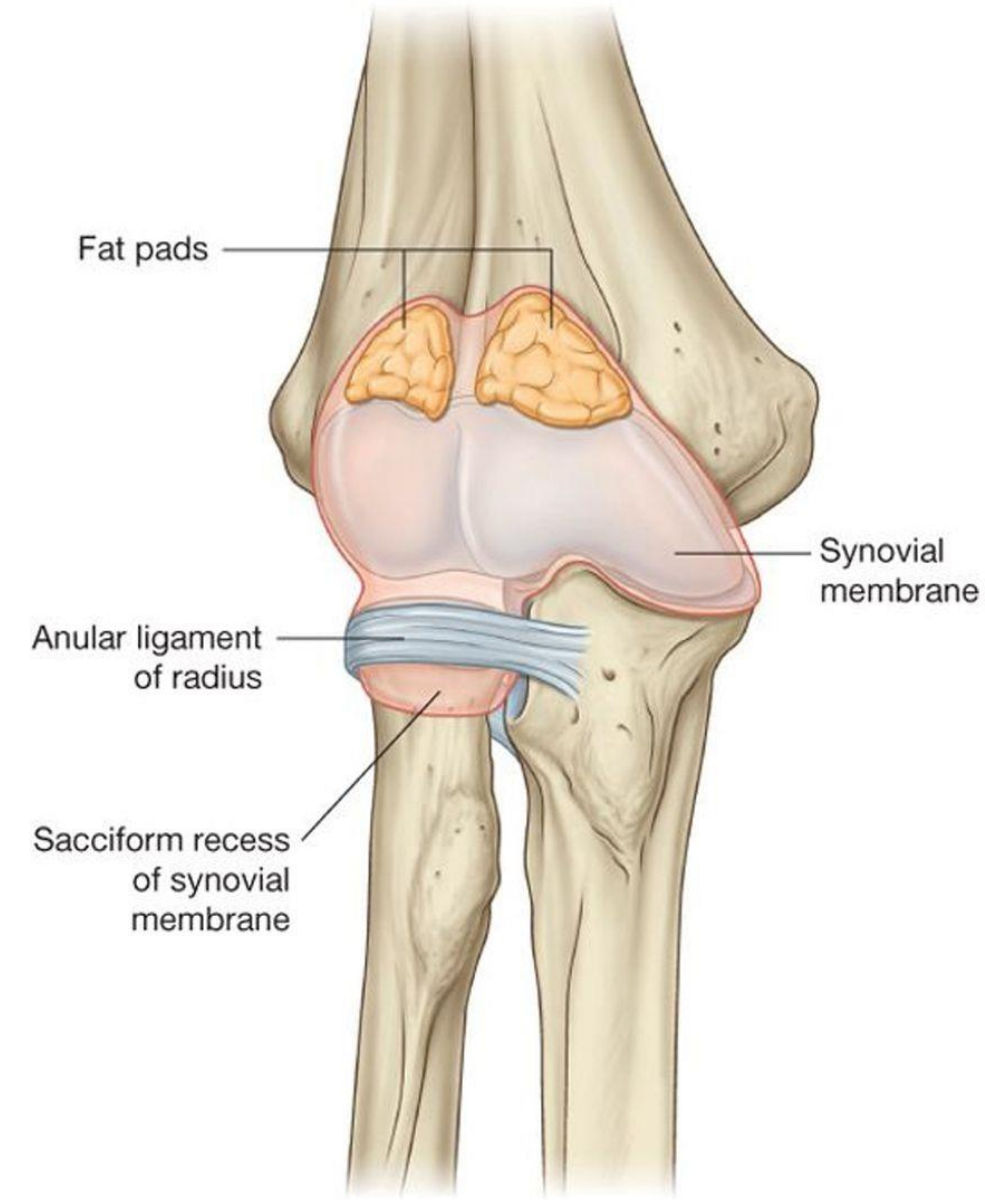
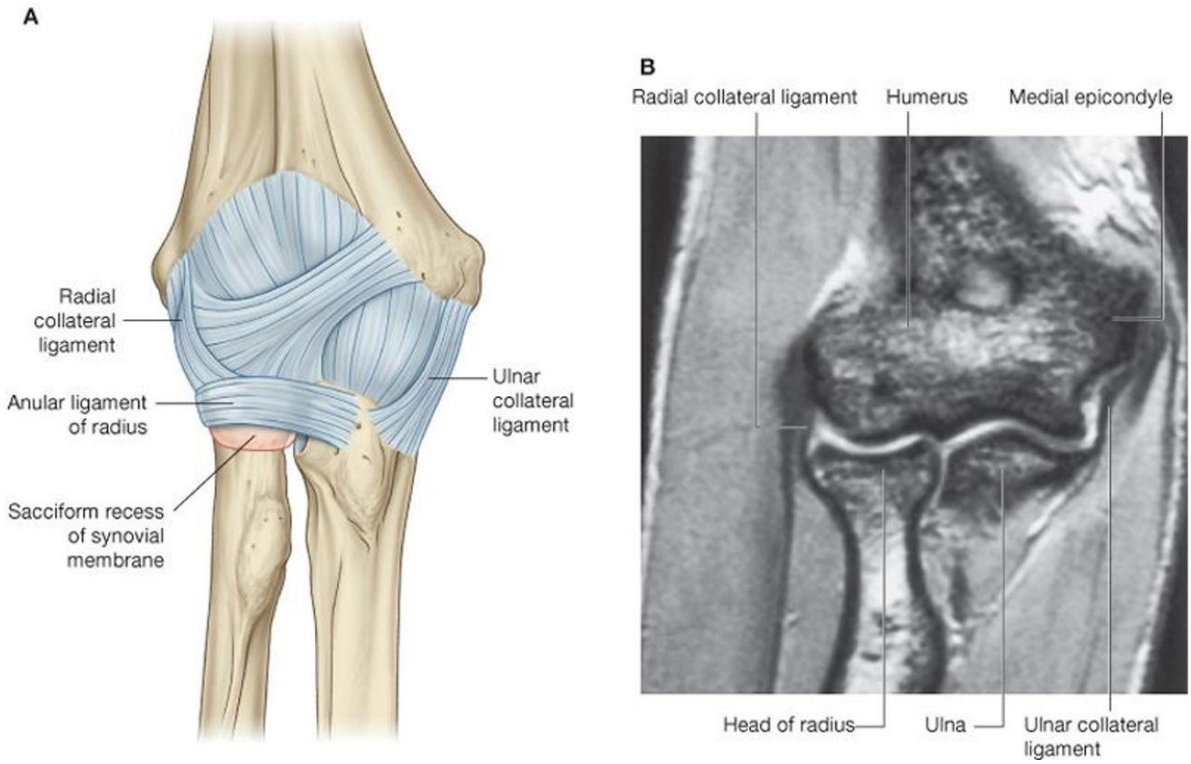


Figure 3: Elbow joint. A. Joint capsule and ligaments of right elbow joint. B. Magnetic resonance image of elbow joint in coronal plane. Gray's Anatomy for Students.[17]



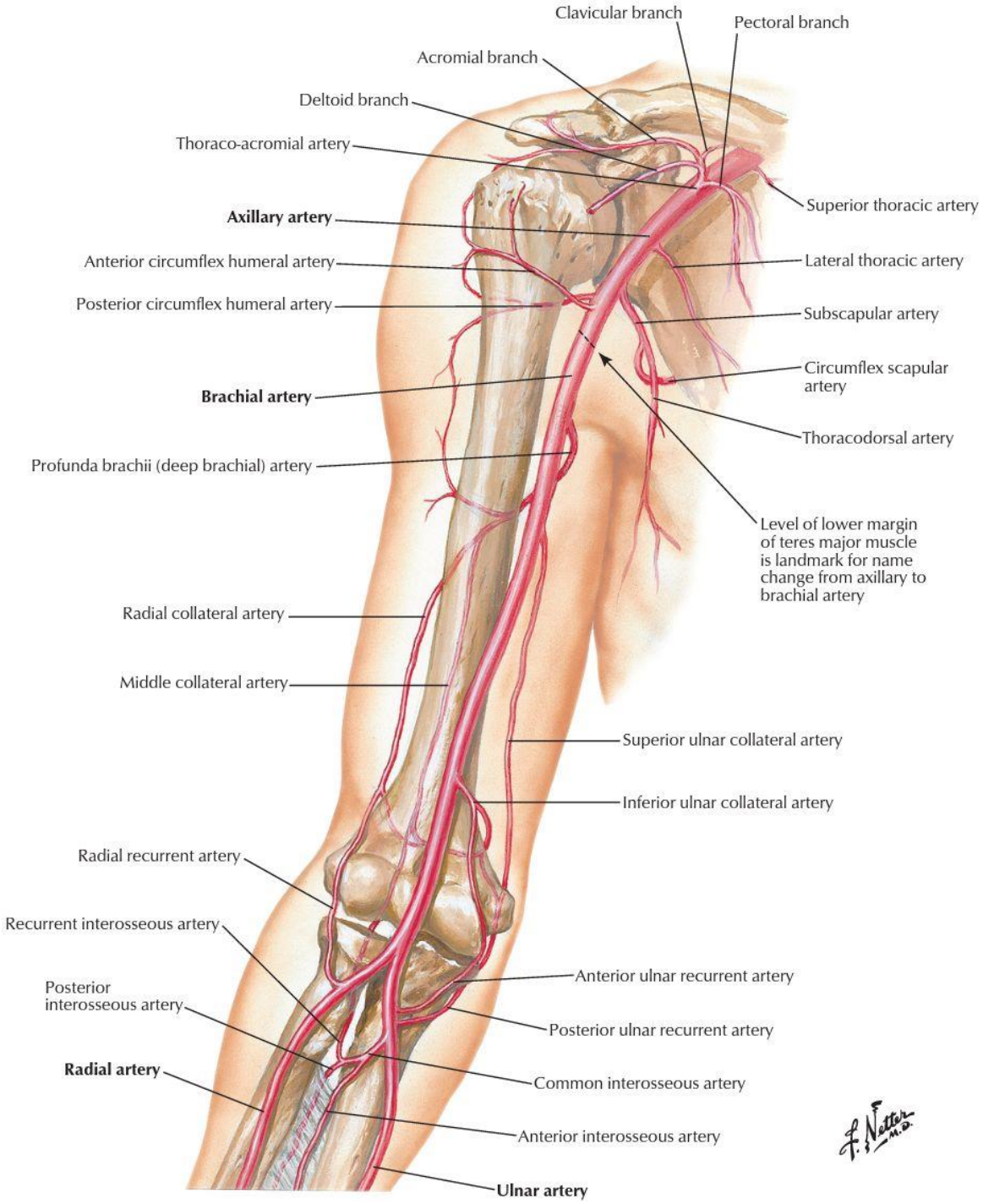
Blood supply and lymphatics

Majority of the neurovascular in the upper extremities crosses at the elbow joint. Many of these structures can be seen using ultrasonography because they are often superficial in nature. All major arteries supplying elbow joint originate from brachial artery, one of axillary artery's continuations. Brachial artery has several branches, including a deep brachial artery that runs posteriorly and gives rise to few more arteries that eventually anastomose with radial artery. Brachial artery, which divides into radial and ulnar arteries, carries majority of blood flow.[18]

Epitrochlear and supratrochlear lymph nodes, latter consisting of up to five nodes located above to medial epicondyle, and deep and superficial cubital lymph nodes are the main lymphatic structures around elbow joint. Axillary lymph nodes are where lymph

eventually ends up after draining up the arm and passing through deep brachial lymph nodes.[18]

Figure 4: Blood supply. Netter. Atlas of Human Anatomy. 6th ed[15]



Nerves

Forearm and hand structures are primarily innervated by nerves that traverse elbow joint. Musculocutaneous nerve is one of the main nerves of elbow joint. Biceps brachii, which is primarily responsible for supination and some elbow flexion, as well as the brachialis, which is in control of elbow flexion, are both innervated by this nerve, which never crosses the elbow joint itself. Beginning medially in the proximal humerus, the radial nerve spirals laterally and posteriorly before entering the spiral groove. The radial nerve travels laterally across the elbow joint before entering the radial nerve groove in the distal humerus. Brachialis (lateral component), anconeus, supinator muscle, brachioradialis, and triceps brachii are five muscles that are innervated by this nerve. Ulnar nerve remains in medial arm and passes via the cubital tunnel and ulnar nerve groove as it moves from the anterior compartment to the posterior compartment. Muscles in the hand and forearm are innervated by ulnar nerve. Median nerve travels anteriorly through elbow joint before continuing distally to innervate the forearm and hand muscles. Lateral antebrachial cutaneous nerve and medial antebrachial cutaneous nerve, which descends from musculocutaneous and radial nerves, respectively span elbow joint. Skin of the forearm receives sensory innervations from these two nerves.[19]

Muscles

Around elbow joint, several muscles cross over. Secondary stability of joint is accomplished by these muscles. Majority of muscles originate from elbow joint primarily function as flexors and extensors of wrist, hand, and digits rather than providing much movement at elbow joint itself. Its protection against valgus and varus forces helps to maintain elbow stability. Pronator teres, flexor digitorum superficialis, flexor carpi ulnaris, and flexor carpi radialis are muscles counteract valgus forces by generating a varus force. Extensor digitorum communis, extensor carpi radialis brevis and longus, anconeus, and

extensor carpi ulnaris are muscles that contribute to varus stability by producing a valgus force. Muscles that control flexion, such as biceps brachii, brachioradialis, and brachialis, predominantly affect elbow joint. Biceps brachii is main muscle in charge of supination and has a modest effect on elbow flexion. With two distal attachments at elbow joint, more laterally oriented tendon inserting on proximal radius, and a medially directed aponeurosis extending into proximal forearm fascia, biceps brachii is especially unique. Triceps brachii are nearly exclusively responsible for extending elbow joint, with very little help from anconeus muscle.[20]

Figure 5: Muscles, superficial and deep layers. Netter. Atlas of Human Anatomy. 6th ed[15]

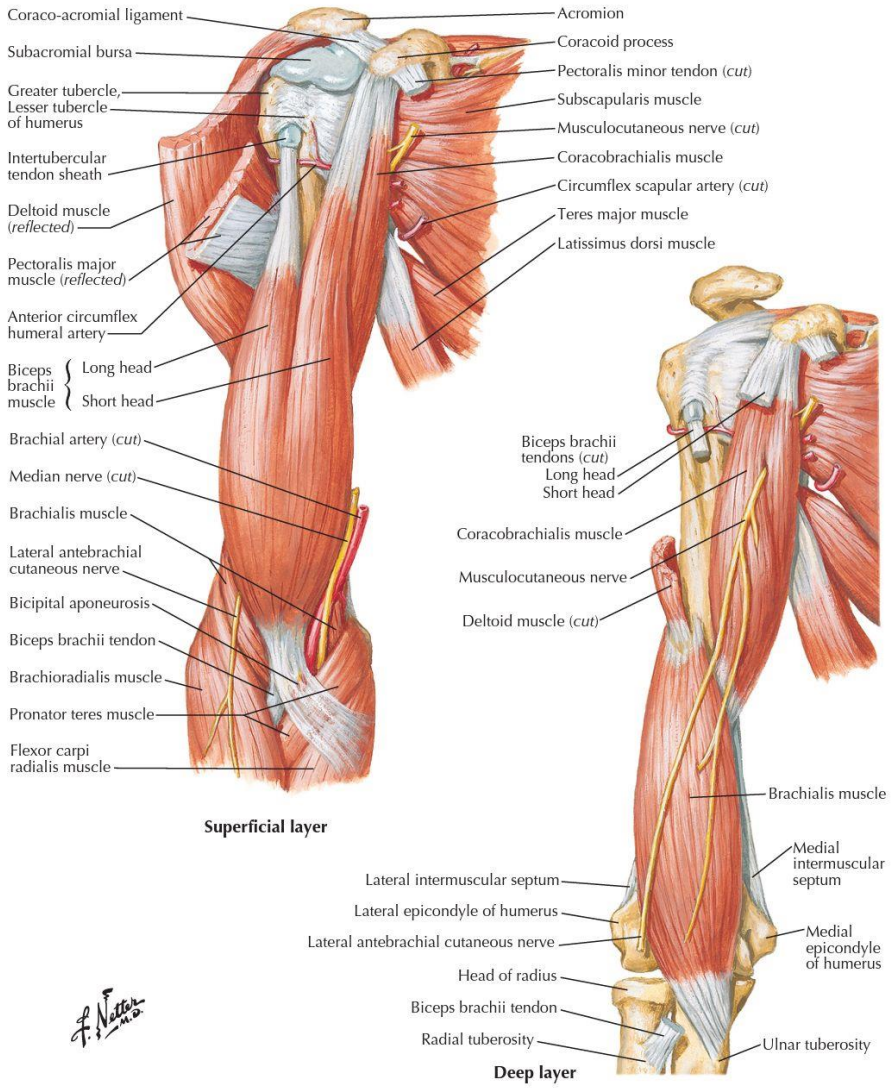


Figure 6: Attachments of Muscles of forearm: Anterior view. Netter. Atlas of Human Anatomy. 6th ed[15]

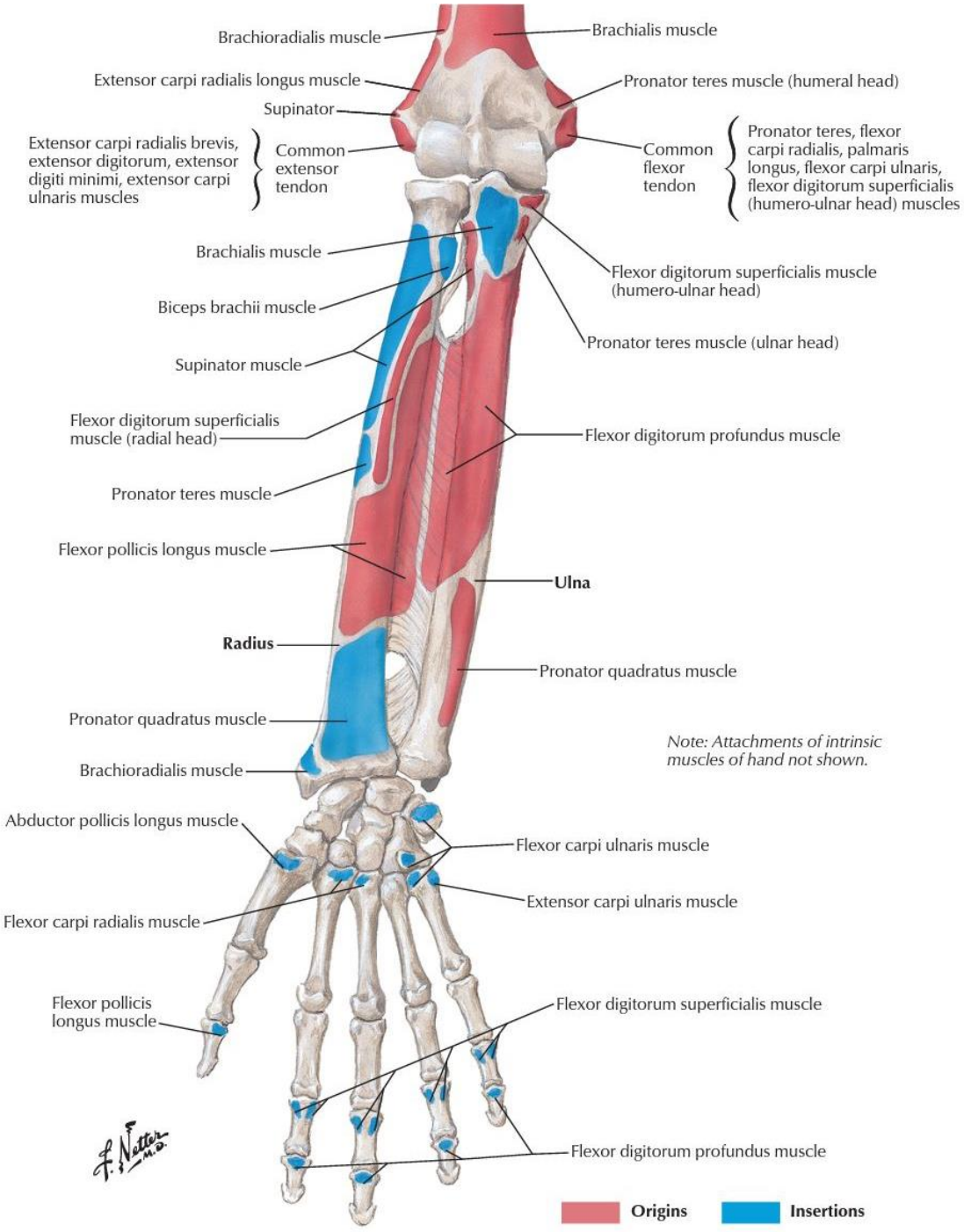


Figure 7: Attachments of muscles of forearm: Posterior view. Netter. Atlas of Human Anatomy. 6th ed[15]

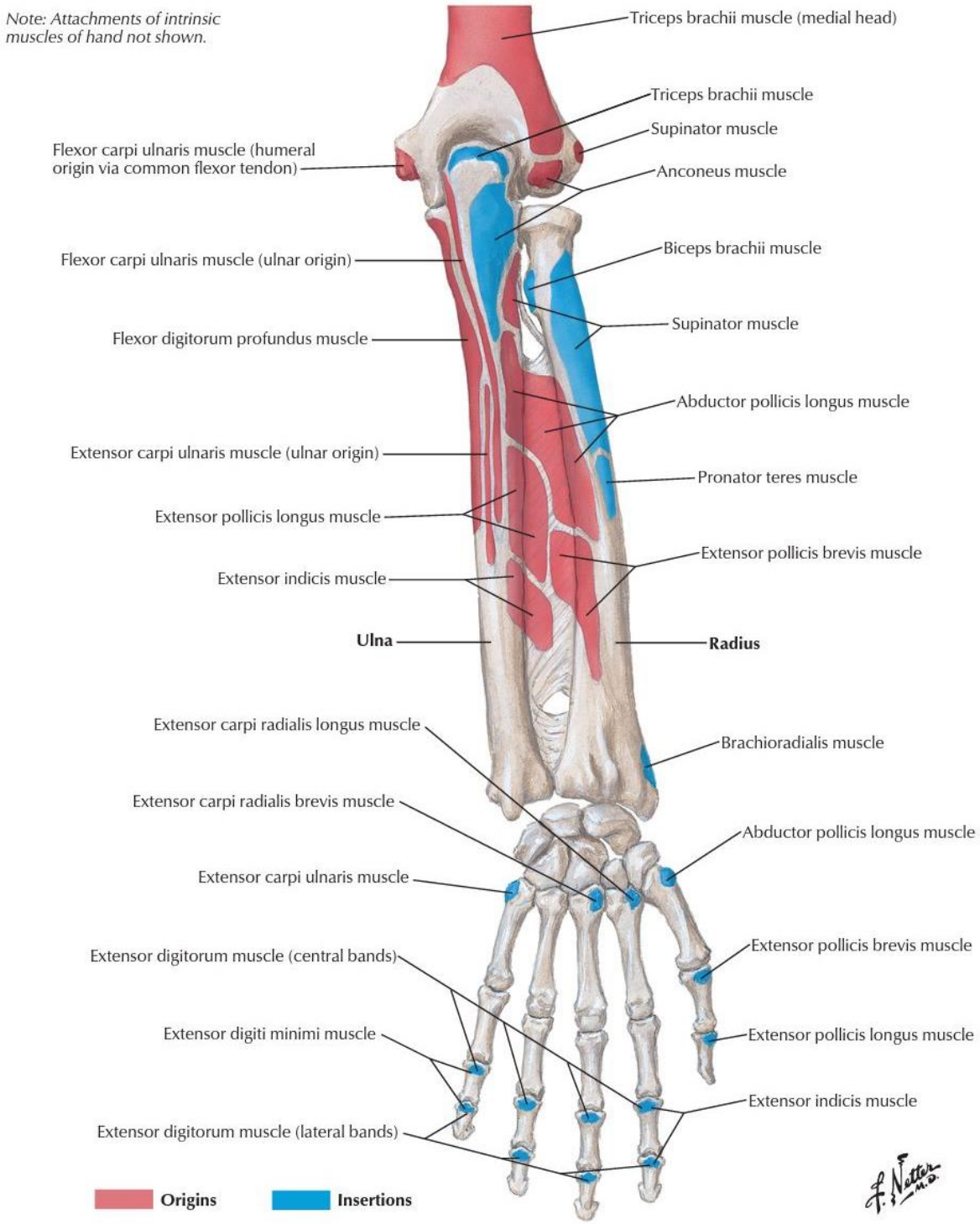


Table 1: Anatomy of Muscles of Lateral Compartment of the Elbow.[21]

Muscle	Function	Origin	Insertion
Extensor carpi radialis longus	Extends and abducts wrist	Distal aspect of lateral supracondylar ridge of the humerus and lateral intermuscular septum	Dorsum of the base of the second metacarpal bone
ECRB	Extends wrist	Common extensor tendon from lateral epicondyle of humerus	Dorsal aspect of the base of third metacarpal bone
Extensor digitorum communis	Extends wrist and second through fifth digits at MCP joints	Common extensor tendon from lateral epicondyle of humerus	Dorsum of the second through fifth digits
Extensor carpi ulnaris	Extends and adducts wrist	Humeral head: common extensor tendon from lateral epicondyle; ulnar head: dorsal aspect of the mid ulna	Ulnar aspect of base of fifth metacarpal bone
Extensor digiti minimi	Extends the proximal phalanx of the fifth digit at the MCP joint and aids in wrist extension	Common extensor tendon from the lateral epicondyle of the humerus	Dorsal expansion of fifth digit
Anconeus	Tightens joint capsule and acts as a weak extensor of elbow	Posterior aspect of lateral epicondyle of humerus	Radial aspect of olecranon and proximal ulna
Supinator	Supinates the forearm	Humeral head: lateral epicondyle; ulnar head: lateral aspect of olecranon (supinator crest)	Lateral and anterior aspect of proximal to mid radius

Lateral epicondylitis.

Tennis elbow which is also known as lateral epicondylitis (LE), is an overuse condition that results from an eccentric overload of common extensor tendon at origin of extensor carpi radialis brevis (ECRB) tendon. Tennis elbow is frequently an overuse condition brought on by repeated wrist extension or loaded gripping, which are common in certain jobs and

activities. It historically affects tennis players, although it can also happen in any sport that demands repetitive wrist extension, radial deviation and/or forearm supination. It also can be observed in athletes who participate in other sports or activities which require similar movements, such as badminton and squash. In the sports patient group, this ailment is frequently brought on by incorrect equipment, poor mechanics, and technique. [22]

According to intensity of pain, Nirschl and Ashman's proposed classification scheme divided LE into seven phases. Even though there isn't a perfect match between histological lesions and clinical characteristics of each phase, the suggested theoretical correlation between them can assist direct LE treatment. [22]

Table 2: Clinical classification of lateral epicondylitis phases.[23]

Phase	Description of pain changes of different phases
I	Mild pain after activity, usually recovers within 24 hours
II	Mild pain more than 48 hours after activity, no pain during activity, can be relieved with warm-up exercises, and recovers within 72 hours
III	Mild pain before and during activity, no significant negative impact on the activities, and can be partially relieved with warm-up exercises
IV	Mild pain accompanies the activities of daily living and has negative impact on the performance of activities
V	Harmful pain unrelated to activities, great negative impact on the performance of activities but does not prevent the activities of daily life. Need complete rest to control the pain
VI	Persistent pain despite complete rest and can prevent the activities of daily life
VII	Consistent pain at rest, aggravated after activities, and disturbed sleep

Notes: Phases I and II pain typically self-limits with appropriate care and protection; phases III and IV pain typically need some nonoperative treatments; and phases V through VII pain is more likely to need surgical intervention.

Four stages of tendinosis were defined by Kraushaar and Nirschl, making it easier to understand how LE degenerates.[24]

Table 3: Pathologic stages of lateral epicondylitis

Stage	Degenerative changes of tendinosis
I	Peritendinous inflammation with no pathological alterations
II	Involving pathological alterations such as tendinosis or angiofibroblastic degeneration
III	Involving pathological changes and complete structural failure
IV	Involving fibrosis, soft matrix calcification, and hard osseous calcification, in addition to the features of stage II or III

Epidemiology

Most frequent cause of elbow symptoms in patients who come with general elbow discomfort is lateral epicondylitis. Men and women are typically affected equally by the condition. Incidence varies from one to three percent annually in the US. Despite the fact that tennis players make up just 10% of the patient population, the illness is frequently called "tennis elbow." Tennis players have elbow pain in 50% of cases, 75% of which are true tennis elbow. It occurs more frequently in those over the age of 40. In general population, smoking, obesity, vigorous activity (handling physical loads exceeding 20 kg), and repetitive movement for at least two hours each day are risk factors for acquiring this illness. Illness progresses favorably over its natural course, with 80–90% of patients experiencing spontaneous recovery within one or two years. [25,26,27]

Etiology

Numerous theories about causes of lateral epicondylitis have been put up in the literature.[28,29,30]

Significant causes are:

- Extra articular radio-humeral bursitis.
- Osteochondral radio-capitellar lesion.
- Posterior interosseous nerve entrapment syndrome or Radial tunnel syndrome.

- Cervical spondylosis and cervical disc disorders at C5-6 or C6-7 level with referred pain to elbow.
- Posttraumatic periostitis.

Recent studies show that extensor carpi radialis brevis (ECRB) superficial and deep fibers are where the lesion first occurs. This involves repeated micro tears or partial tears of tendon fibers, which results in fibrous scar tissue and increases risk of additional injury. Extensor digitorum communis, extensor carpi radialis longus, and extensor carpi ulnaris were the sites of first damage, according to studies. Injured tendon continues to be torn by repetitive overload, frequent contraction of extensor compartment muscles, and inappropriate gripping techniques of rackets or other equipment, which exacerbates the symptoms of lateral epicondylitis.

Risk factors

A meta-analysis identified some demographic traits that could be linked to lateral epicondylitis. These included the dominant hand, older age, female, and smoking history. Furthermore, despite the fact that diabetes mellitus was not discovered to be linked to lateral epicondylitis in this review, a high HbA1C and high blood glucose level were.[31,32,33,34] Histopathological studies have revealed a lack of inflammatory cells, such as macrophages and neutrophils, in people with lateral epicondylitis.[34,35] This shows that an inflammatory condition is unlikely to be the etiology of lateral epicondylitis. It is more likely the outcome of a prolonged degenerative process. In various disease models, it has been demonstrated that factors including elderly, a history of smoking, and the presence of chronic illnesses accelerate the degenerative process.[36,37] Recent research has also shown that underutilization can increase the risk of damage, apart from excessive use. When tendons are underutilized, they frequently experience lesser loads than usual. This results in structural weakening of the tendon, increasing their susceptibility to damage and degeneration.[38]

Pathophysiology

Repeated contraction of forearm extensor muscles, particularly near origin of ECRB, results in micro tears with subsequent degeneration, immature repair, and tendinosis, which is cause of lateral epicondylitis. The ECRB experiences increased varus stress due to mechanical pressures as well as its unique anatomic location against lateral aspect of the capitellum, which exposes tendon to repetitive undersurface abrasion during elbow extension.[39] Degeneration and tendinosis are further aided by lack of vascularity at tendon surface.[39] The damaged tendon looks gray and friable under close inspection. Initially, it was thought that inflammation affecting radial humeral bursa, synovium, periosteum, and annular ligament was the cause of epicondylitis.[40] Nirschl and Pettrone first reported their discovery of "angiofibroblastic hyperplasia" in 1979, which they jointly referred to as disturbance of normal collagen architecture by invading fibroblasts in conjunction with an immature vascular reparative response.[43] Due to the absence of inflammatory cells, same process was later referred to as "angiofibroblastic tendinosis".[41,42] Term tendinosis is preferable to epicondylitis or tendinitis since inflammation is not a key component of epicondylitis. As scar tissue develops over time, it becomes more susceptible to repeated trauma, which causes more tearing. The cycle of injury and immature repair is continued, leading to larger tears, which modify and fail the musculotendinous biomechanics and aggravate symptoms.[43] Any one or more of the following traits may be present in combination with the histologic appearance of pathologic ECRB specimens. Vascular hyperplasia, collagen disorganization, hypertrophic or numerous fibroblasts, and lack of inflammatory cells.[2] LE patients who experience unpleasant symptoms frequently involuntarily "underuse" or stress shield the afflicted tendons, compromising their structural integrity and increasing their susceptibility to damage.[44] While this is going on, rising shear stresses encourage the creation of fibrocartilaginous at tendon enthesis, which weakens

tendon-bone junction and starts development of tendinosis.[45] Regarding the LE's pain mechanism, most studies attribute the disease's pathophysiology to a neurogenic etiology based on a number of lines of evidence showing existence of nerve fibers that are responsive to neuropeptides such substance P (SP) and calcitonin gene-related peptide (CGRP).[46,47,48] Varicose fibers in form of a single fiber or nerve bundles were identified as the immunoreaction to the neurokinin-1 receptor. The findings offer new proof that LE and ME may have a neurogenic etiology. According to Uchio et al the pathophysiology of LE may involve the neuropeptides SP and CGRP as well as the cytokines interleukin-1 (IL-1) and tumor growth factor (TGF).[42]

Clinical presentation

When patients grab objects with resistance while extending their wrists, lateral elbow pain typically gets worse. During physical examination, tenderness noted near origin of ECRB, about 1 cm distal to the epicondyle's midportion. Reduced strength with resisted gripping, as well as supination and wrist extension, is also common. Maneuvers such as "chair test" (in which the patient is asked to lift a chair with a pronated hand) and "coffee cup test" (in which the patient is asked to lift a coffee cup with a pronated hand).[49]

On physical examination, place of greatest pain is typically above lateral epicondyle, but it can also occur in a localized, distal region one to two centimeters away from lateral epicondyle. Entire tendon may be slightly discomfortable to palpate, and the adjoining muscle may be significantly tight. Resisted wrist extension will exacerbate or replicate the patient's pain, especially when elbow is extended and forearm is pronated. Further evidence for the diagnosis can be seen in painful resisted extension of middle finger while elbow is extended due to increasing strain on tendon. Notably, radicular symptoms or

numbness/tingling should be absent. Although both illnesses can coexist, as these symptoms point to a different mechanism, such as radial nerve entrapment.[50]

Diagnosis

A careful history and physical examination is necessary for diagnosis of epicondylitis. Even though conservative therapy is frequently effective, magnetic resonance imaging (MR) or ultrasonography (US) may be used to confirm diagnosis in cases of persistent or confounding symptoms, assess severity of tendon injury, identify related abnormalities, and assist in preoperative planning.

Cozen's test, commonly referred to as resisted wrist extension test, is a sort of provocative testing. Examiner's thumb holds patient's elbow at 90° of flexion throughout this test as they palpate patient's lateral epicondyle. Patient is then instructed to create a fist, pronate forearm, deviate radially, and extend wrist against examiner's physical resistance. Test results in pain or reproduction of other symptoms in area of lateral epicondyle, test is considered positive. Usually, tenderness is felt over 5 mm anterior and distal to the lateral epicondyle.[51] Patient is asked to close their hand while their wrist is in dorsiflexion and their elbow is extended. This test is known as Mill's test. The wrist is pressed into flexion throughout examination, and lateral epicondyle is palpated. If patient has any pain on lateral epicondyle, they refuse to move, and the test is considered positive.[52]

According to research by Miller et al, MR imaging had a sensitivity range of 90% to 100%, whereas US had a range of 64% to 82% for detecting both medial and lateral epicondylitis. [57] Elbow radiography frequently yields negative results; however, it could show calcium accumulation close to the lateral epicondyle and aid in ruling out other pathologic conditions. [53] Proton density-weighted and T2-weighted rapid SE images are best for detecting anomalies in tendons and ligaments (with or without fat saturation). On T1- and

T2-weighted images, tendinosis can be seen as intermediate signal intensity within tendon substance, most frequently ECRB, with or without tendon thickening. [54,55]

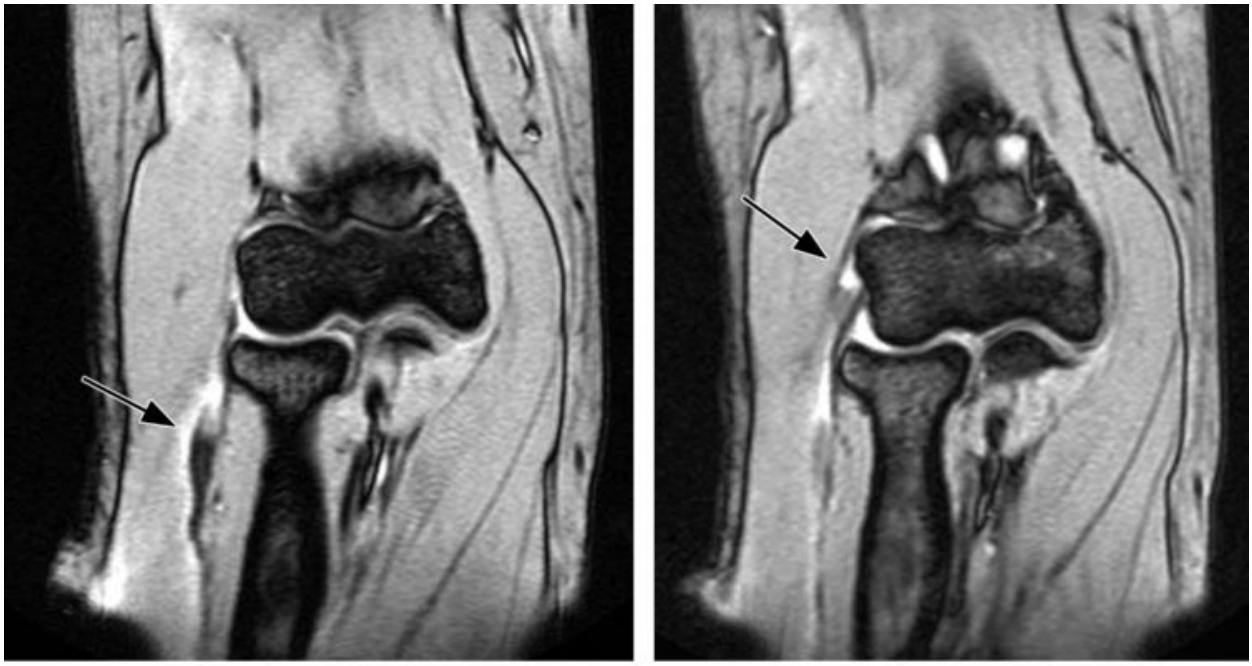


Figure 8: LE in severe form. (a) A 40-year-old woman's coronal GRE MR scan shows a full-thickness tear and retraction of ECRB with nearby edema (arrow). (b) Location of anticipated ECRB tendon origin is indicated by a fluid-filled gap (arrow) in the coronal GRE MR image at level of lateral epicondyle.[29]

Complications

Recurrence of injury after returning to normal activity, rupture of tendons from repeated steroid injections, and failure of conservative treatment are all potential complications of lateral epicondylitis.[29]

Postoperative complications can include the following:

1) Failing to address concomitant pathology.

- Patients should be informed of risks and benefits of surgery; former include but are not limited to infection, blood loss, neurovascular injury, continued pain, stiffness, or

continued or worsening general dysfunction. Patients report inferior outcomes and lack of improvement if primary cause of symptoms is not addressed.

- In up to 5% of individuals being treated for lateral epicondylitis, radial nerve entrapment may be overlooked or not addressed clinically.

2) Iatrogenic LUCL injury.

- If the surgical dissection extends over radial head equator, it occurs iatrogenically with a higher risk.
- If LUCL is seriously compromised by extension, postoperative iatrogenic posterolateral rotatory instability (PLRI) may result.

3) Iatrogenic neurovascular injury.

- Injury to radial nerve

4) Heterotopic ossification.

- Reduce risk by liberally irrigating with saline solution after decortication and debridement.

5) Infection.

Management

The condition is typically treated conservatively in patients by stopping the offending activity, applying ice, giving an injection of a nonsteroidal anti-inflammatory medicine (NSAID) or corticosteroid, and wearing a brace or splint.[56] Following these steps is a rehabilitation program designed to gradually improve strength, flexibility, and endurance with the goal of eventually reintroducing the injured person into their previous sport or line of work.[49] Any biomechanical irregularities that might have caused the initial injury must be corrected during recovery. Other therapies include extracorporeal shock-wave therapy, injections of autologous blood or platelet-rich plasma, ultrasonographically guided

tenotomies, and the use of iontophoresis and phonophoresis to deeply penetrate topical medicines into soft tissues.[57] If there is no clinical improvement after 3 to 6 months of conservative therapy, surgery is frequently recommended. Deteriorated tendon is dissected, released, and debrided using open and arthroscopic surgical procedures.[56,58]

Excision of the diseased tissue (debridement) without reattachment to the lateral epicondyle has been the focus of several therapeutic strategies for refractory lateral epicondylitis, and open, arthroscopic, and percutaneous approaches have all shown promising long-term clinical results. [59,41,2,60,61,62] Despite the overall success, there have been reports of long-term postoperative discomfort and function loss. After isolated debridement, up to 15% of cases met the criteria for failure (defined as a low outcome score and/or reoperations).[63,64,62] As a result, it has been suggested that anatomic restoration of the common extensor tendon to the lateral epicondyle, together with debridement, be used to treat the ongoing discomfort and functional loss in these patients.[65,66,67,68] A minor lateral incision used in open surgery is followed by dissection and identification of the deteriorated tendon. The primary tendon structure can be restored, extended, and fixed by drilling or decorticating the lateral epicondyle after the debridement of denatured tendon tissues.[69,58] The common extensor tendon origin at the lateral epicondyle is mostly released by a percutaneous surgical technique. This method has been shown to be risk-free, dependable, and economical.[70,71] Recent studies have shown that the unique approach known as ultrasound-guided percutaneous tenotomy (UGPT) is safe and effective for treating LE. At a 1-year follow-up, the technique showed persistent improvements in terms of symptoms, function, and ultrasound imaging.[72]

At 4 years following open debridement (OD) and concurrent tendon restoration, excellent results and appreciable gains in grip and pinch strength testing have been observed. After OD, it has been proposed that reattaching or repairing the ECRB tendon with suture

anchors leads to superior short- and long-term functional outcomes as well as reduced failure rates than OD alone.[66,67]

Prognosis

In general, lateral epicondylitis has a favorable prognosis. Most patients will have pain relief after conservative treatment within a year (ice, rest, and anti-inflammatory medications). Different physical and occupational therapy may be beneficial for people who do not get better after receiving first care. Symptoms frequently return in patients who don't stick to their therapeutic regimen.[73]

Role of PRP injection in chronic Lateral epicondylitis

By centrifuging a larger amount of patient's blood, platelet-rich plasma (PRP) is an autologous human plasma preparation with a higher platelet content. Transforming growth factor-1 (TGF-1), platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF), epidermal growth factor (EGF), and insulin-like growth factor-1 (IGF1) are just a few of the growth factors and mediators found in platelets alpha granules that are concentrated during centrifugation to deliver supraphysiologic levels of these growth factors and cytokines to an injury site and support natural healing process.[74]

Hematology is where PRP's concept and definition first emerged. PRP, which originally served as a transfusion product to treat patients with thrombocytopenia, was first coined by hematologists in the 1970s to refer to plasma with a platelet count exceeding that of peripheral blood. PRP was first used as PRF in maxillofacial surgery ten years later. Fibrin might have adhesion and homeostatic capabilities, and PRP's anti-inflammatory properties might encourage cell growth. PRP has since been utilized mostly in the treatment of sports injuries to the musculoskeletal system. It has received a great deal of media attention because to its use by professional athletes and is widely employed in this industry. Cardiothoracic

surgery, pediatric surgery, gynecology, urology, plastic surgery, and ophthalmology are more medical specialties that utilize PRP.[75]

PRP can be prepared using two techniques:

1. Open technique: the product is in contact with various materials that should be utilized for their manufacture, such as pipettes or product-collection tubes, and is exposed to surroundings of the working area. It should be ensured that the product is clean throughout microbiological handling while processing blood to create PRP using open procedure.

2. Closed technique: it entails the utilization of commercial equipment bearing the CE mark, including centrifuge machinery and software, so that the product is not exposed to the environment (recommended).

For the creation of autologous PRP, several Conformite Europeenne (CE) medical devices are available. Most of them are a part of one of the three categories of devices listed below:

1. An anticoagulant-filled tube that may be used with any kind of centrifuge is used to collect the blood.
2. Medical devices that collect blood into a tube with an anticoagulant already present; any sort of centrifuge can then be used to do the centrifugation.
3. Devices used in medicine that collect blood into syringes that have already been pre-filled with an anticoagulant; typically, the blood is transferred into a secondary device whose shape imposes the use of a centrifuge from the same manufacturer.[76]

Pharmacokinetics and Dynamics

The underlying scientific theory behind PRP therapy holds that injection of concentrated platelets at the site of injury may begin tissue repair by releasing a variety of biologically active factors (growth factors, cytokines, lysosomes, and adhesion proteins) that are in charge of starting the hemostatic cascade, producing new connective tissue, and revascularization.

The platelet-poor plasma fraction also contains plasma proteins such fibrinogen, prothrombin, and fibronectin (PPP). PRP concentrates can induce the supraphysiological release of growth factors to quicken the recovery from acute injuries and chronic wounds.[77] Numerous growth factors, cytokines, and locally acting regulators participate in the majority of fundamental cell processes at all stages of tissue repair via endocrine, paracrine, autocrine, and intracrine systems. The primary benefits of PRP are its safety and the ingenious preparation methods utilized by modern commercial machines to create a biologic with a wide range of application possibilities.[78]

Classification

Four major families of preparations were proposed by Dohan Ehrenfest et al. in 2009 based on the presence or absence of a cell content (such as leucocytes) and the fibrin architecture.[79]

1. Pure PRP or leucocyte-poor PRP: After activation, the resulting preparation, which is free of leucocytes, displays a low-density fibrin network.
2. Leucocyte and PRP: Leucocytes are present in the preparations, which after activation display a low-density fibrin network.
3. Pure PRF or leucocyte-poor PRF: The preparations contain a high-density fibrin network and are free of leucocytes. These products, which exist in the form of an active gel and cannot be injected, are either pure PRP or PRP that contains leukocytes.
4. Leucocyte-rich fibrin and PRF: Products are leucocyte- and fibrin-based high-density network preparations.

DEPA (Dose, Efficiency, Purity, Activation) classification, which focuses on number of platelets collected by the PRP kits as well as on product purity and platelet activation prior to injection, was proposed by Magalon et al. in 2016. DEPA classification is based on 4

different components: Dose of injected platelets, Efficiency of production, Purity of PRP obtained, and activation process.[95]

In a randomized controlled study comparing the efficiency of local injections of autologous PRP and local steroids in reducing pain and improving function in a cohort of patients with LE, it was found that there were highly significant differences between the two groups in terms of VAS and DASH scores prior to treatment (first visit) and six weeks later (second visit), with a p-value of 0.001.[80] However, there is a highly significant positive link with pain scores at 12th and 24th weeks following the procedure, indicating importance of age in outcome of treatment, according to Paramanatham et al. Young age has therefore responded effectively to PRP injection care in individuals with tennis elbow compared to growing age in terms of pain.[81] Mean pain VAS Score decreased from 7.7 before the injection to 5.4 after two weeks, 4.1 after six weeks, 3.2 at twelve weeks, and 1.8 at the final follow-up, which is six months after the injection, in study of patients with lateral epicondylitis who had been resistant to conventional treatment for three months. Prior to injection, 93% of patients had very severe to severe tenderness at lateral epicondyle of elbow; this improved to none of the patients having severe or very severe tenderness, and 93% of patients had either no or only mild tenderness at lateral elbow at the time of final follow-up. Oxford elbow score, which measures functional result, increased from a mean of 19.2 before treatment to 41.3 following the injection at the last follow-up.[82]

Injections of activated PRP and autologous whole blood (AWB) were compared in a randomized clinical trial to see which was more effective in terms of pain relief and functional outcome at 4 weeks, 8 weeks, and 4 months. The results showed that there was initially little difference between the two groups of patients. At 6 months, however, the PRP group's scores had slowed, and the VAS and Nirschl scores were considerably lower ($p = 0.01$ and $p = 0.001$, respectively) in the PRP group. This discrepancy persisted over the last

12-month follow-up as well. When compared to the AWB group, the PRP group's pain scores at 12 months post-injection were considerably lower (VAS: 3.12 (SD 2.45) versus 4.88 (SD 2.0), p = 0.007; Nirschl grade: 1.73 (SD 1.5) versus 2.75 (SD 1.67), p = 0.004). In conclusion, at long-term follow-up, activated PRP injection showed statistically significant decreased pain compared to the autologous blood injection group (12 months). However, creation of platelet concentrates necessitates the use of expensive, time-consuming specialized equipment. Compared to PRP, autologous blood is much simpler and easier to apply. Autologous blood injection has several benefits, including being extremely accepted, effective, economical, simple to perform as an outpatient operation, and free from potential problems including hypoglycemia, skin atrophy, and recurrences linked to corticosteroid injection.[83]

According to a prospective, randomized study comparing effectiveness of arthroscopic lateral release and autologous PRP injections in treatment of chronic LE, the positive short- and medium-term outcomes provided by PRP justify its careful use as a first-line therapeutic approach and in patients who do not wish to undergo surgery; two additional PRP injections can be given in the event of persistent pain and tenderness. Arthroscopic approach is dependable, barely invasive, and beneficial for long-term clinical outcomes.[84]

Role of intralesional corticosteroid injection in chronic Lateral epicondylitis

The most frequent treatment for lateral epicondylitis historically has been an injection of corticosteroids. The effectiveness of this solution must be contrasted with that of a "wait and see" strategy because the condition is frequently self-limited. Since 1950, intralesional injections of steroids have been used to treat tennis elbow.[85] Injections of steroids help people move more easily and decrease pain and inflammation.[86] However, the local steroid injection's great pain relief is only observed to continue for around six weeks. Despite this,

they have been reported to be more effective than oral analgesics and anti-inflammatory medications.[87] Systemic steroids and orally delivered analgesics and anti-inflammatories can both be dosed more conservatively after receiving steroid injections into the afflicted joints. When surgery is not an option due to a medical condition, corticosteroid injections may temporarily reduce the need for surgery or provide relief. Although some studies indicate there is no significant difference over the long run between corticosteroids and a placebo, the therapeutic effects of corticosteroids are frequently transient.[88]

Triamcinolone acenotide (Kenacort-40), methylprednisolone acetate (Depo-Medrone), and dexamethasone (Decadron) are the most widely used corticosteroids. Triamcinolone hexacenotide (Aristopan), betamethasone acetate (Celestone), and hydrocortisone are additional steroids that are utilized internationally.[89] Non-particulate steroids include hydrocortisone and dexamethasone. Particulate steroids, such as methylprednisolone acetate and triamcinolone acenotide, are made up of microcrystals that are 3–15 times smaller than erythrocytes and have different degrees of aqueous solubility.

Table 4: Comparative dose equivalents for the different steroids and particle size compared to a maximum 7.5 mm for erythrocyte.[89,90]

Steroid	Equivalent dose to 40 mg triamcinolone acetonide (mg)	% of particles >10 mm
Methylprednisolone acetate (Depo-Medrone)	40	45
Triamcinolone acetonide (Kenacort)	40	45
Bethamethasone acetate (Celestone)	6	35
Dexamethasone sodium	1.5	0

Reduced synovial blood flow, altered synovial fluid composition, gene repression of leukocytes, protease and cytokine production, and altered collagen synthesis are examples of analgesic and anti-inflammatory processes.[91,79] Because they are less soluble, these effects

are stronger in corticosteroids with branched esterification. Triamcinolone acetonide, the least soluble steroid, has been found to have a therapeutic duration of up to 21.1 days when administered with microcrystalline agents, which prolong their time at the injection site.[91,79] The half-life of more soluble steroids is as little as a few hours, and they are absorbed from the joint more quickly.[79] They are processed by the liver and eliminated by the kidney after being absorbed from the joint.

Table 5: Common indications and contraindications for corticosteroid injection.[89,79]

Indications:
Inflammatory arthropathy
Degenerative arthropathy
Soft tissue/bursal inflammation
Transforaminal/epidural
Absolute contraindication
Local or intra-articular sepsis
Broken skin or at site of injection
Fracture or joint instability
Allergy to constituents of injectate
Joint destruction
Unstable coagulopathy
Relative contraindication
Prosthetic joint
Severe juxta-articular osteoporosis
Injection three times within the preceding year or less than 2 weeks

Smidt et al comprehensive analysis of randomized controlled trials concluded that corticosteroids proved to be useful in short term for up to six weeks, while further study is needed to determine the best timing, dosage, and injection technique. At intermediate or long-term follow-up, these positive short-term effects, such as reduced discomfort and improved grip strength, were not present. Contrarily, there is evidence that suggests corticosteroid injections may result in more positive outcomes for medication or physical therapy at long-term follow-up when compared to alternative conservative treatment.[51]

In study, Tonks et al. recommended steroid injections alone as initial course of treatment for patients with lateral epicondylitis who needed to resume everyday activities as soon as possible. Physiotherapy, which in some cases requires patient to visit outpatient physiotherapy department up to six times for treatment with subsequent loss of time and/or earnings for patient, is much more time and cost-inefficient than injections alone in terms of both pain relief and function improvement. In addition, the negative effects of steroid injection are often mild and readily tolerated.[92]

Okçu G et al discovered that the injection technique affects the long-term clinical success of treating lateral epicondylitis. Long-term results suggest that the peppering method outperforms the single injection method. Single injection of 1 ml betamethasone and 1 ml prilocaine was given to Group 1 at the site of maximum tenderness on the lateral epicondyle. Patients in Group 2 received an injection of same medication combination. Approximately 30 to 40 times after the first injection, needle point was redirected and reinserted down bone without leaving the skin, resulting in a hematoma.[93]

Stefanou A et al. compare corticosteroid injection to corticosteroid iontophoresis in his study and stated that corticosteroid iontophoresis is preferable to corticosteroid injections as a treatment for lateral epicondylitis. When compared to the beginning of hand therapy, the grip strength of iontophoresis patients demonstrated statistically significant improvement.

Additionally, they had a higher likelihood of returning to work unrestricted. All groups had comparable results for all outcomes that were measured during the 6-month follow-up. Because grip strength and unrestricted return to work were much better for this group, dexamethasone administered via iontophoresis produced short-term benefits. According to this study, lateral epicondylitis patients may benefit from using the iontophoresis approach to deliver corticosteroids.[94]

In contrast to no intervention or nonsteroidal anti-inflammatory medicines, corticosteroid injection provided a short-term reduction in pain, according to Olaussen et al systemic review (SMD 1.43, 95% CI 1.64 to 1.23). A decrease in grip strength (SMD 0.48, 95% CI 0.73 to 0.24), an increase in pain (SMD 0.32, 95% CI 0.13 to 0.51), and a negative impact on the overall improved effect (RR 0.66 (0.53 to 0.81) were noted in his study. With inconsistent data for discomfort, there was no difference in overall improvement and grip strength at the long-term follow-up. According to study, treating lateral epicondylitis with corticosteroid injection and manipulation combined with exercise was more effective in short term than using a control. While exercise-based therapy did not vary from control in the intermediate term, corticosteroid injection therapy did. Both therapies had no longer-term advantages over control. [95]

At 2 weeks, 6 weeks, and 6 months after receiving a peppered injection of a steroid and lignocaine mixture, mean Patient Rated Tennis Elbow Evaluation (PRTEE) score was 22.36, 18.40, and 14.16, respectively, according to a prospective randomized study, whereas in the group that received a single injection, it was 28.96, 21.84, and 25.32 (p value 0.05). VAS scores were observed to be 2.72, 1.72, and 1.36 at 2 weeks, 6 weeks, and 6 months following the peppered injection and to be 2.96, 1.92, and 2.72 at 2 weeks, 6 weeks, and 6 months following the single injection, respectively (p value 0.05). The VAS ratings at 6 months post-injection and the PRTEE scores at 6 weeks and 6 months in the group receiving

peppered injections were significantly lower when the two groups were compared (p value 0.05).[96]

In a study examining the efficacy of corticosteroid injection, multimodal physiotherapy, or both in patients with unilateral lateral epicondylalgia, corticosteroid injection resulted in lower complete recovery or much improvement at 1 year compared to placebo injection (83% vs 96%, respectively; relative risk [RR], 0.86 [99% CI, 0.75-0.99]; P=0.01) and greater 1-year recurrence (54% vs 2%; RR, 0.23 [99% CI, 0.10-0.51]; P<0.001). The 1-year evaluations of full recovery or significant improvement (91% vs. 88%, respectively; RR, 1.04 [99% CI, 0.90-1.19]; P=0.56) or recurrence (29% vs. 38%; RR, 1.31 [99% CI, 0.73-2.35]; P=0.25) did not show any differences between the physiotherapy and no physiotherapy groups. Similar patterns were observed at 26 weeks, with no difference between the physiotherapy and control groups (71% vs 69%, respectively; RR, 1.22 [99% CI, 0.97-1.53; P=0.84) and lower complete recovery or much improvement after corticosteroid injection compared to placebo injection (55% vs 85%, respectively; RR, 0.79 [99% CI, 0.62-0.99]; P0.001). At 4 weeks, there was a significant interaction between corticosteroid injection and physiotherapy (P=0.01), and patients who received the placebo injection along with physiotherapy had a greater chance of fully recovering or improving than those who received no physiotherapy (39% vs. 10%, respectively; RR, 4.00 [99% CI, 1.07-15.00]; P=0.004"). Patients getting the corticosteroid injection along with physical therapy did not differ from those receiving the corticosteroid injection alone (68% vs. 71%, respectively; RR, 0.95 [99% CI, 0.65-1.38]; P=0.57). They concluded that physiotherapy did not significantly vary from corticosteroid injection in terms of clinical results among individuals with chronic unilateral lateral epicondylalgia.[97]

Comparison of the efficacy of single dose IL-PRP with single dose IL-CS injection in chronic lateral epicondylitis

Epicondylitis has been treated with a variety of methods, such as nonsteroidal anti-inflammatory medications, physical therapy, topical anesthetics, autologous blood components, etc. Although corticosteroid injections are the gold standard, their effects are very temporary (2–6 weeks).[98] It has been demonstrated that applying autologous PRP to different tissues to achieve a high local concentration of platelet-derived growth factors can speed up the healing of wounds, tendons, and bones.[99] In a randomized controlled study, Peerbooms et al. compared the efficacy of PRP with corticosteroid injections in treating patients with chronic lateral epicondylitis and found that 73% of the PRP group and 49% of the corticosteroid group saw good outcomes (p 0.001). In addition, 51% of corticosteroid group and 73% of the PRP group in their study achieved favorable outcomes based on the DASH scores (p = 0.005).[121] It's important to note in their study that PRP group progressively improved whereas corticosteroid group initially improved and subsequently decreased.

A different RCT revealed that the PRP group received successful treatment more frequently than corticosteroid group (P .0001), where success was indicated by a 25% decrease in VAS or DASH scores without need for reintervention after two years. Both groups considerably improved over time when 2-year follow-up VAS and DASH ratings were compared to scores at baseline (intention-to-treat principle). However, although DASH scores of the PRP group dramatically increased, those of the corticosteroid group reverted to baseline levels (as-treated principle). There were no issues associated with using PRP.[100]

According to a retrospective analysis of prospectively collected data on individuals with lateral epicondylitis, PRP treatment resulted in a lower DASH score than local corticosteroid injection over short-term follow-up period (3 months). Other than that, it was

interesting to notice that at the 6-month follow-up, the PRP regimen had considerably lower VAS and DASH scores than the steroid regimen. During first six months of follow-up period, there was no noticeable difference between two arms in terms of the MAYO elbow index; however, at 12 months, the patients managed with local PRP injections outperformed those managed with local corticosteroids.[101] In a research by Gautam et al VAS for pain, DASH score, Oxford Elbow Score, modified Mayo score, and hand grip strength all significantly increased from pre-injection to 6-month follow-up. Scores, however, in CS group typically peaked at 3 months and subsequently slightly declined at 6 months, indicating a recurrence of symptoms that affected 46.7% of the CS patients.[5]

According to a comparison study, mean VAS score for Steroid group was 7.68 0.945 at beginning and 2.41 1.652 at 26 weeks. For the PRP group, it was initially 7.86 1.082 and at 26 weeks, it was 1.73 1.932. Mean improvements in Mayo scores were 22.73 7.07 and 5.27 1.2, respectively, for the Steroid group and 6.14 1.98 and 21.73 10.955 for the PRP group. Regarding the decrease in VAS score for both groups, the PRP group's p value was found to be 0.02 and therefore significantly higher than the steroid groups.[102]

Corticosteroid and PRP both showed equivalent efficacy in a randomized trial at short-term follow-up (1 and 2 months), however PRP continued superior to steroid when patients were assessed at 6 months. One month following the treatment, individuals who received PRP reported an average improvement in VAS ratings of 70% (8.33–3.45) as opposed to 70.6% (7.98–2.34) in PRP group. At one month, there was no noticeable difference between two outcomes (P = 0.639). Similarly, after one month, PRP-treated patients' MAYO ratings increased by 29.4% (61.51-79.62) compared to the steroid group's 23.3% improvement (63.92-78.87), with no statistically significant difference (P = 0.490). Similar outcomes were seen after two months, and for VAS and MAYO scores, respectively, both treatment modalities were equivalent with P = 0.249 and 0.471. At the end of six months, VAS scores

of PRP-treated patients had improved by an average of 91% (8.33–0.69) compared to the steroid-treated patients' scores, which had improved by an average of 42.2% (7.98–4.61). This difference between two groups was statistically significant (P = 0.000). MAYO elbow scores also improved by a mean of 54.4% in PRP-treated patients (range: 61.51–95.0), compared to 1.25% in steroid-treated patients (range: 63.92–63.12), a result that was statistically significant (P = 0.0001).[103]

Short-term data analysis in a systematic review and meta-analysis revealed a moderately strong medium effect size of CS over PRP for pain reduction (SMD, 0.56; 95% CI, 0.14-0.99; I2 = 86%; P = 0.009) with statistical significance. With low quality of evidence, there were no differences in short-term DASH scores (SMD, -0.18; 95% CI, -0.88 to 0.51; I2 = 88%; P = 0.6). Long-term analyses showed that, in contrast to short-term analyses, improvements in pain scores were reversed: PRP significantly outperformed CS in terms of pain relief, with a very large effect size (SMD, -1.3; 95% CI, -1.9 to -0.7; I2 = 85%; P 0.0001), despite the low quality of the available data. According to the findings of this systematic analysis, PRP injections have a much larger long-term benefit than CS injections for pain outcomes in LE, whereas CS injections have a medium short-term benefit.[104]

A prospective interventional study reported that pre-injection VAS score was comparable in both intralesional steroid and PRP groups. The difference of pre-injection VAS score was not much significant statistically. Both group of patients showed improvement in pain and functionality, reflected by decreasing VAS, FPS and DASH scores at 4 and 8 weeks. However, at 12- and 24-weeks improvement achieved with PRP was much better than the steroid. In the steroid group they cease to improv after 12 months and some patients even started experiencing pain again at 24 weeks. There is a significance difference between the two groups outcome seen at 24 weeks. Percentage of effect along with effect size achieved is also large in PRP group. From the above, it was concluded that both steroid and

PRP are good for short term pain relief in management of lateral epicondylitis. However, in long term and sustained pain control PRP showed better outcome than steroid. Risk of recurrence is high with steroid than with the PRP.[105]

According to a literature review of randomized controlled studies comparing PRP with corticosteroids for treatment of epicondylitis in EMBASE, Medline, the Cochrane Library, and PubMed, local corticosteroid injection resulted in a significantly higher Disabilities of the Arm, Shoulder, and Hand (DASH) score at 4 weeks (WMD, 11.90; 95% CI: 7.72 to 16.08; P0.00001; heterogeneity, x2=0, I2=0%, P=1.00) and 8 weeks (WMD, 6.29; 95% CI: 2.98 to 9.60; P=0.0002, x2=0, I2=0%, P=1.00). Other than that, it was interesting that at the 24-week follow-up, the PRP regimen had substantially lower VAS and DASH scores than the steroid regimen (WMD, -2.61; 95% CI: -5.18 to -0.04; P=.05; heterogeneity, x2=29.85, I2=97%, P0.00001; x2=0.20, I2=0%, P=0.66). In comparison to patients treated with corticosteroids, PRP-treated patients experienced more successful outcomes (WMD, 3.33; 95% CI: 1.81 to 6.14; P=.000; heterogeneity, x2=0.43, I2=0%, P=.51). During the short follow-up period, local corticosteroid injections for treating lateral elbow epicondylitis performed better than local PRP treatments (4 weeks and 8 weeks post-treatment). However, PRP injections had reduced pain and enhanced function more significantly than corticosteroid injections at long-term follow-up (24 weeks after therapy).[10]

MOST RELEVANT STUDIES:

A prospective study conducted by Paramanantham et al. (2022) determined functional outcome of PRP injection in LE patients. The difference in pain score means derived using VAS and MAYO scores at 12 and 24 weeks is statistically significant. There is a highly substantial positive link between age and pain levels at the 12th and 24th weeks after the treatment. Tennis elbow patients who receive PRP injections report much less pain, as evaluated by VAS and MAYO scores. Patients who are younger in age have benefited more from PRP treatment in terms of pain reduction. [95]

Comparative study by Prakash et al. (2022), the effects of injecting a steroid and lignocaine mixture using single injection and peppered injection techniques, and then analyzed results in each category. They concluded that the peppered injection strategy is preferred to single injection technique in the treatment of chronic lateral epicondylitis.[96]

Patients with chronic lateral epicondylitis were separated into two groups in a longitudinal observational study by Kurian et al. (2021), with one group receiving PRP treatment and the other corticosteroid treatment (methyl prednisolone). Patients in the PRP group achieved a mean reduction in VAS score of 6.14 at end of 26 weeks, compared to a drop in VAS score of 5.5 in the steroid group at the same time. For the patients in the PRP group, VAS score improvement was statistically significant (P = 0.02). In addition, all 22 patients in the Mayo scores group of 22 patients shown improvement in function compared to individuals in PRP group. After 26 weeks, the PRP group of patients reported less discomfort than the Corticosteroid group of patients. The survey suggests that PRP injections significantly reduced pain and enhanced function after 26 weeks, outperforming the effects of corticosteroid injections.[102]

Kadam et al. examined the clinical and functional results of individuals with Lateral Epicondylitis elbow treated with local corticosteroid injection vs platelet rich plasma (2021).

Other 37 patients, whose mean age was 37.20 years, received treatment with an intralesional injection of 2 milliliters of 40 milligrams of triamcinolone diluted with 2 milliliters of 0.5% bupivacaine. 37 patients, with a mean age of 34, were divided into one group and given intralesional autologous platelet rich plasma (PRP) injections. Following therapy, VAS Score, DASH Score, and MAYO Elbow Performance Score were evaluated three times: at three months, six months, and finally at twelve months. The outcomes were established using these assessments. Although pain relief is essentially the same with both types of therapy, this study found that PRP injection delivers a slightly better functional outcome than corticosteroid injection.[101]

Clinical efficacy of PRP and CS injections in lowering pain and enhancing function in LE and PF was compared in a comprehensive review and meta-analysis of 20 trials by Huang et al. (2020) with 1268 participants. When compared to CS, PRP for LE has very large effect size of 1.3 (95% CI, 1.9 to 0.7) and offers a statistically and clinically significant long-term relief in pain, although the quality of the evidence was poor. With a medium effect size of 0.56 (95% CI, 0.08-1.03) when compared to PRP, there is modest evidence that CS reduces pain in EE patients over the short term statistically significantly, albeit this improvement may not be clinically relevant. There was limited evidence that PRP provides a statistically and clinically significant long-term improvement in function, despite the relatively substantial effect size of 1.94 (95% CI, 0.61-3.28) for PF (American Orthopedic Foot & Ankle Society score). Although, quality of evidence was low, there was no significant difference between groups in the improvement of function for LE, pain, and short-term function for PF. PRP reduces long-term pain more effectively than CS when treating LE, both statistically and clinically.[104]

In the year 2020, Japatti et al performed a prospective interventional study to determine efficacy of intralesional steroids and PRP in patients with lateral epicondylitis. Pre-injection

VAS score difference was statistically insignificant. At 4 and 8 weeks, the VAS, FPS, and DASH ratings for both groups of patients decreased, indicating an improvement in both pain and functional status. However, at 12 and 24 weeks, PRP's improvement was far superior to the steroids. After 12 months, the progress in the steroid group stops, and some patients even started feeling pain again at 24 weeks. At 24 weeks, there is a statistically significant difference between two groups' results. In PRP group, percentage of effect and size of the effect both exceeded expectations.[105]

15 patients were selected by Islam et al. (2019) and performed a study. The study's goal was to determine how platelet-rich plasma affected 15 patients with lateral epicondylitis. Selected people received paracetamol, guidance on daily living activities, and intralesional injection of platelet-rich plasma. Every 14 days, patients were evaluated using a visual analogue scale, with patient rating tennis elbow examination. According to visual analogue scale and patient-rated tennis elbow evaluation tool, the difference in improvement from pretreatment W1 (immediately before the first intervention) score to the W11 score in every other week was detected in relation to time. This shows that lateral epicondylitis of the elbow patients benefits from intralesional platelet-rich plasma.[106]

Randomized, prospective, interventional study on 200 patients was done by Das et al. (2019). Aim of study was to evaluate PRP's effectiveness in treating lateral epicondylitis in comparison to a more commonly used steroid. Improvement was noticeably better in PRP injection group compared to corticosteroid injection group (P 0.001). This study's findings support the notion that PRP injection therapy and local corticosteroid therapy are both straightforward outdoor treatments for lateral epicondylitis. PRP, however, offers better long-term treatment and has hardly any side effects.[107]

Effectiveness of locally injected autologous PRP was assessed by Saurabh et al. using the functional oxford elbow score, a pain score, and an ultrasonographic evaluation of the

morphologic alterations (2018). Mean pain VAS Score decreased from 7.7 prior to injection to 1.8 at the end of the study, or six months following injection. Oxford elbow score increased from a mean value 19.2 before the injection to 41.3 at last follow-up. The elbow in question underwent ultrasonography, which revealed a decline in localized hypoechoic, a reduction in edema, an improvement in tendon thickness, and healing of tear at site of origin. Study demonstrates that local PRP improves tendon repair and healing properties by releasing growth factors and increasing vascularity, which is supported by improved tendon morphology, and enhances stromal and mesenchymal stem cell proliferation, increases tendon vascularity, and prevents Angio fibroblastic degeneration.[82]

Sandhu et al. (2018) performed a study on 50 patients. Comparison of both modalities' efficacy and functional results was the study's primary objective. A single 2 mL injection of autologous PRP (4.8 times plasma) in group 1 was given along with 1 ml of calcium chloride as an activator, while a 2 mL injection of autologous whole blood (AWB) was given to group 2. Both groups then underwent elbow-strap, stretching, and strengthening exercises. At 0, 4, 8 weeks, 6 months, and 12 months, visual analogue scale (VAS) and NIRSCHL staging (NS) were used to evaluate pain and functional outcomes. At short and intermediate follow-up intervals, pain measures, including VAS and Nirschl ratings, significantly improved in both groups, but over long follow-up intervals, PRP demonstrated superior improvement in terms of pain, functional improvement, and recurrence of symptoms. PRP and AWB injections are helpful for treating chronic lateral epicondylitis, however PRP's efficacy tends to last longer than AWB's.[83]

In a prospective randomized study by Merolla et al. (2017) on 101 patients aimed to compare the effectiveness of arthroscopic lateral release and autologous platelet-rich plasma (PRP) injections in treating chronic lateral epicondylitis (LE). In every measurement, both patient groups saw a significant improvement. Only grip strength at week 8 revealed a

substantially higher value in the PRP group in between-group comparisons; all other significant differences, including overall pain, night pain, PRTEE score at week 104, grip strength at weeks 24, 52, and 104, were in favor of arthroscopy. Rescue painkiller usage did not differ significantly across the group. Results of the current study show that both PRP injections and arthroscopic extensor carpi radialis brevis release are effective in the short- and medium-term, but that PRP patients' pain significantly worsened at two years, and that arthroscopic release produced better long-term results in terms of pain relief and grip strength recovery. Both procedures were also found to be safe.[84]

Significant improvement of VAS and MAYO was observed after six months of treatment with PRP in patients with elbow epicondylitis by Varshney et al. (2017). Study design was randomized study. Whereas in steroid treatment group, at 1- and 2-months following intervention, there was no statistically significant difference between two groups. The study concluded that treatment of patients with epicondylitis with PRP reduces pain and significantly increases function, exceeding effect of corticosteroid injection.[103]

In meta-analysis study by Chou et al. (2016) they appraised existing evidence of autologous blood injection in treating lateral epicondylitis. According to the findings of the meta-analysis that considered pain scores, autologous blood injection is superior to corticosteroid injection (standard mean difference: 0.75; 95% confidence interval: 1.14 to 0.37) but not superior to platelet-rich plasma injection (standard mean difference: 0.09; 95% confidence interval: 0.66 to 0.84). All included studies showed a moderate to high risk of bias, according to the risk of bias evaluation. The study conclusion indicates that when compared to corticosteroid injection, PRP injection is not more effective than AB injection. Risk of bias evaluation revealed that all of included studies had a moderate to high risk of bias.[108]

In a comprehensive review, Arirachakaran et al. (2016) compared the clinical results related to the usage of PRP, AB, and CS injection. The effects of AB injection were significantly better than those of CS, with unstandardized mean differences (UMD) in pain visual analog scale (VAS), Disabilities of Arm Shoulder and Hand (DASH), Patient-Related Tennis Elbow Evaluation (PRTEE) score, and pressure pain threshold (PPT) of 2.5, 25.5, 5.3, and 9.9, respectively. In terms of VAS and DASH scores, PRP injections performed significantly better than CS. PRP revealed much better VAS with UMD when compared to AB injection. The relative risk of side effects with AB injection is higher than that of CS, 1.78. (1.00, 3.17). Network meta-analysis indicated no statistically significant difference between PRP and AB injections in numerous active treatment comparisons of VAS, DASH, and PRTEE. However, as compared to PRP injection, AB injection had a better DASH score and PPT. The risk of side effects was higher with AB injection than PRP injection.[7]

Gautam et al. (2015) performed a study to assess clinical and ultrasonographic changes in the common extensor tendon's shape and vascularity after receiving platelet-rich plasma (PRP) or corticosteroid injections for intractable lateral epicondylitis (LE). PRP and CS groups, there was a significant improvement in the VAS for pain, DASH score, Oxford Elbow Score, modified Mayo score, and hand grip strength from pre-injection to the 6-month follow-up. The scores, however, in the CS group typically peaked at 3 months and subsequently slightly declined at 6 months, indicating a recurrence of symptoms that affected 46.7% of the CS patients. The proportion of patients who tested positive for various ultrasonographic findings generally reduced at 6 months. Number of patients in CS group, however, increased from 2 to 12 in terms of reduced common extensor tendon thickness and from 9 to 11 in terms of cortical erosion at the lateral epicondyle. PRP seemed to promote biological repair of lesion, whereas CS seemed to provide symptomatic relief for a limited time but led to tendon deterioration.[6]

In total 65 patients were recruited by Yadav et al. (2015). Purpose of study was to compare efficacy of PRP versus methyl-prednisolone local injection in patients with lateral epicondylitis. When compared to the baseline, all evaluation parameters significantly improved in both Groups at each follow-up. After three months, group A greatly outperformed group B in terms of improvement. Both PRP and methyl-prednisolone work well for treating lateral epicondylitis. For longer-lasting efficacy, PRP is a superior therapeutic choice.[109]

In the year 2013, Krogh et al. performed a randomized controlled study to determine whether a single PRP injection is more successful at reducing pain in adults with LE after three months than a placebo (saline) or glucocorticoid. There was no statistically significant difference between groups in terms of pain reduction at 3 months (the primary end point); mean differences were as follows: glucocorticoids versus saline: 3.8 (95% CI, 9.9 to 2.4); PRP versus saline: 2.7 (95% CI, 8.8 to 3.5); and glucocorticoids versus PRP: 1.1 (95% CI, 7.2 to 5.0). Mean differences were as follows: glucocorticoid against saline: 8.1 (95% CI, 14.3 to 1.9); and glucocorticoid versus PRP: 9.3 (95% CI, 15.4 to 3.2). At one month, however, glucocorticoids reduced pain more effectively than both saline and PRP. In terms of secondary outcomes, glucocorticoids were superior to PRP and saline at 3 months in lowering color Doppler activity and tendon thickness. Mean differences for color Doppler activity were: glucocorticoids against PRP: 2.6 (95% CI, 3.1 to 2.2); and glucocorticoids versus saline: 2.0 (95% CI, 2.5 to 1.6). The mean differences for tendon thickness were as follows: glucocorticoids versus PRP: 0.5 (95% CI, 0.8 to 0.2); and glucocorticoids versus saline: 0.8 (95% CI, 1.2 to 0.5). Regarding pain relief in LE at major end point at 3 months, neither a PRP injection nor a glucocorticoid injection were more effective than saline.[110]

Krogh et al. (2013) conducted a systematic review and meta-analysis to evaluate comparative effectiveness and safety of injection therapies in patients with lateral

epicondylitis. Glucocorticoids, Botulinum Toxin, Autologous Blood, Platelet-Rich Plasma, Polidocanol, Glycosaminoglycan, Prolotherapy, and Hyaluronic Acid were all included in the 17 trials. Glucocorticoid injection was no more beneficial than a placebo after 8 weeks (SMD [95% confidence interval]: 0.04 [0.45 to 0.35]), although only 1 trial (which omitted a placebo arm) was at low risk of bias. Botulinum toxin caused transitory paresis of finger extension and had a marginally positive effect (0.50 [0.91 to 0.08]), and all trials were highly susceptible to bias. Although just 1 experiment had a low risk of bias, autologous blood and platelet-rich plasma were significantly superior to placebo (1.13 [1.77 to 0.49] and 1.43 [2.15 to 0.71] respectively). Hyaluronic acid (5.58 [6.35 to 4.82]) and prolotherapy (2.71) were both more effective than a placebo, although polidocanol (0.39 [0.42 to 1.20]) and glycosaminoglycan (0.32 [1.02 to 0.38]) had no impact. Only the prolotherapy and polidocanol trials satisfied the requirements for low risk of bias.[85]

Systematic review by Olaussen et al. (2013) reported that Injections of corticosteroids have a positive short-term impact on lateral epicondylitis but a poor long-term impact. Conflicting evidence exists on long-term effect. Stretching has a long-term effect in addition to a short-term impact, as do manipulation, exercise, and other activities.[95]

Comparison of Effectiveness of local injection of autologous PRP and local steroid in terms of reducing pain and improving function in patients with LE was mainly focused by Omar et al. (2012) in their randomized controlled study. Significant changes between VAS and DASH scores were seen in both groups at baseline and six weeks after therapy relative to the LE group of patients. While there were no discernible differences in the VAS and DASH score changes between two groups ($p > 0.05$), A promising kind of treatment for TE was found to be local injection of autologous PRP.[94]

RCT conducted by Gosens et al. (2011) recruited 100 patients. Aim of study was to evaluate effectiveness of PRP compared with corticosteroid injections in patients with

chronic lateral epicondylitis with a 2-year follow-up. In comparison to corticosteroid group, the PRP group experienced more successful treatments (P .0001). Success was determined to be a 25% decrease in VAS or DASH scores after two years without a reintervention. Both groups considerably improved over time when the 2-year follow-up VAS and DASH ratings were compared to scores at baseline (intention-to-treat principle). Although DASH scores of the PRP group dramatically increased, those of corticosteroid group reverted to baseline levels (as-treated principle). Use of PRP did not result in any issues. Even after a two-year follow-up, PRP therapy for patients with chronic lateral epicondylitis dramatically improves function while reducing discomfort, outperforming the effects of corticosteroid injection.[100]

Peerbooms et al. (2010) performed a randomized controlled study on 100 patients. Aim of the study was to identify effectiveness of PRP compared with corticosteroid injections in patients with chronic lateral epicondylitis. A reduction of at least 25% in either the visual analog score or the DASH score after a year of treatment was considered successful. The findings demonstrated a significantly different success rate between the PRP group (37 of 51 patients; 73%) and the corticosteroid group (24 of 49 patients; 49%) based on the visual analog ratings. Additionally, according to DASH ratings, 37 of the 51 patients (73%) in PRP group and 25 of 49 patients (51%) in corticosteroid group both experienced success, which was a significant difference. While PRP group steadily improved, and corticosteroid group's performance improved initially before declining. PRP therapy considerably improves function and significantly reduces discomfort in patients with chronic lateral epicondylitis, outperforming effects of corticosteroid injection.[111]

LACUNAE OF LITERATURE

A few studies were limited to treating tennis elbow patients with PRP injections. In order to treat plantar fasciitis and elbow epicondylitis, platelet-rich plasma (PRP), a promising substitute for conventional corticosteroids (CS), is currently being used more and

more frequently (PF). However, there has been little agreement in synthesis of data about therapeutic efficacy of PRP over CS. An autologous human plasma preparation with a greater platelet concentration is known as platelet-rich plasma (PRP). PRP injections were discovered to be successful in the treatment of tendinopathy and arthritis.

MATERIAL & METHODS

MATERIAL AND METHODS

STUDY DESIGN: A Prospective parallel group comparative study (Randomized control trial).

DURATION OF STUDY: December 2020 to July 2022

SAMPLE SIZE: 54 (Group A 27 patients and Group B 27 patients)

Sample size was calculated using study based on difference in VAS score between PRP and Corticosteroids reported in a study, Gautam et al in [5], using the average variants estimate 0.85 considering and effects size of 25% difference in VAS score. An alpha error of 5% with power of 80 %, the estimate sample size per group is 27 cases of lateral epicondylitis.

Expecting a dropout rate of 10% during the study.[112]

Final sample size of 24 +3= 27 in each group.

The sample size was calculated using the formula.

$$n = \frac{2s_p^2\left[z_{1-\frac{\alpha}{2}} + z_{1-\beta}\right]^2}{\mu_d^2} \qquad s_p^2 = \frac{s_1^2 + s_2^2}{2}$$

Where,

- S_1^2 -Standard deviation in the first group
- S_2^2 - Standard deviation in the second group
- M^2_d – Mean difference between the samples
- α- Significance level of 95%
- 1-β- Power of 80%

INCLUSION CRITERIA:

- Patients aged between 20 and 60 years with clinically diagnosed lateral epicondylitis on one arm and pain persisting for at least 6 weeks, with a positive Cozen's test and Mill's maneuver.
- Pain more than 3 months after a failed conservative treatment.
- Individual with an average pain of 4 or more (0-10) on the visual analogue scale (VAS) in the week prior to the screening visit.

EXCLUSION CRITERIA:

- Individuals whose radiological examination show abnormalities such as calcification, arthritis, and inflammatory arthropathy of the elbow joint.
- Infection at the injection site.
- Individuals with a history of trauma, ligament damage, fracture, tumor or surgery of the elbow joint.
- Patients should not have received a local steroid injection during the previous two months.
- Individuals who have received treatments such as non-steroidal anti-inflammatory drugs (NSAIDS), acupuncture, physiotherapy for lateral epicondylitis during the last 2 weeks.
- Patients with uncontrolled diabetes mellitus.
- Patient on anti-platelet medications.
- Pregnancy.

SOURCE OF DATA:

Lateral epicondylitis patients reporting to outpatient department and admitted as inpatients in Department of Orthopedics attached to R L Jalappa Hospital, which is affiliated to Sri Devaraj Urs Medical College, constituent college of Sri Devaraj Urs Academy of Higher Education and Research, Tamaka, Kolar were included for the study.

METHOD OF COLLECTION OF DATA:

Block randomization technique was used for allotment of cases for group A and group B where Group A received – single PRP dose, Group B – received single corticosteroid dose. Regarding age, sex, weight, height, and body mass index (BMI), randomization made sure that the baseline characteristics of the two groups were compared and pre injection with VAS, Quick DASH score, Oxford elbow score, MEPI.

Informed written consent was obtained from patients who were willing to participate in the study and undergo the procedure treatment. Collection of data from 54 lateral epicondylitis patients within the age group of 20-60 years of either gender was taken up for the study.

In the group A randomized to receive PRP, 10ml of whole blood was collected in a EDTA vacutainer. The blood sample was divided into 2 equal parts of 5ml each in an anticoagulant tube. A peripheral complete blood count was obtained at the time of initial blood draw, by the automated cell counter (Sysmex XN-550) from the remaining sample. PRP containing tubes were made up and down two to four times for thorough mix of blood with anticoagulant. Separation which was done within one hour of collection. Blood was initially centrifuged with a light spin at 2630 Revolutions per minute (RPM) for 3 minutes and 1500RPM for another 15 minutes to sediment the RBCs and WBCs. This device uses a desktop size centrifuge with disposable cylinders to isolate the platelet-rich fraction from the patient's anticoagulated blood, drawn at the time of the procedure. PRP was transferred in the

sterile container. A minimum of 2ml of PRP will be injected into the Lateral epicondylar region.[111] 1ml of PRP was tested for platelet count.

In the group B randomized to receive corticosteroid approximately 2 mL of corticosteroids (triamcinolone acetonide 80mg) injected directly into Lateral epicondylar region.

Patients in the group were received Oral paracetamol 650mg up to a maximum of 3gms per day if they have pain post injection therapy as a rescue medication.

FOLLOW UP VISITS: -

Functional outcomes were evaluated using Visual Analog Scale (VAS), Quick DASH score, Oxford elbow score, MEPI for elbow during follow up period at 1 month, 3 months and 6 months.

Statistical Methods:

Quick-Dash, Oxford Elbow**,** Mayo Elbow Score, etc. were considered as primary outcome variable. Treatment (CS/ PRP) was considered as primary explanatory variable. Age, gender, side, diagnosis etc. were considered as the study relevant variables.

Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency, and proportion for categorical variables.

Categorical outcomes were compared between study groups using Chi square test.

For normally distributed Quantitative parameters the mean values were compared between study groups using independent sample t-test (2 groups). For non-normally distributed Quantitative parameters, Medians, and Interquartile range (IQR) were compared between study groups using Mann Whitney u test (2 groups). P value <0.05 was considered as statistically significant. IBM SPSS version 24 (IBM Corp. Released 2013. IBM SPSS Statistics for windows, version 24.0. Armonk, NY: IBM Corp).[113]

RESULTS

RESULT:

A total of 54 subjects were included into the study.

Table 6: Comparison of Age with Treatment (N=54)

Parameter	Treatment		P Value [Independent T Test Equal Variance]
	CS (STEROID) (N=27)	PRP (N=27)	
	Mean ± SD	Mean ± SD	
Age	41.37 ± 13.24	39.74 ± 11.80	0.6350

The mean of age was 41.37 ± 13.24 in IL-CS treatment and it was 39.74 ± 11.80 in IL-PRP, difference between two treatments were statistically not significant. (p value 0.6350). (Table 6 and figure 9)

Figure 9: Error bar of age (years) in each study group (N=54)

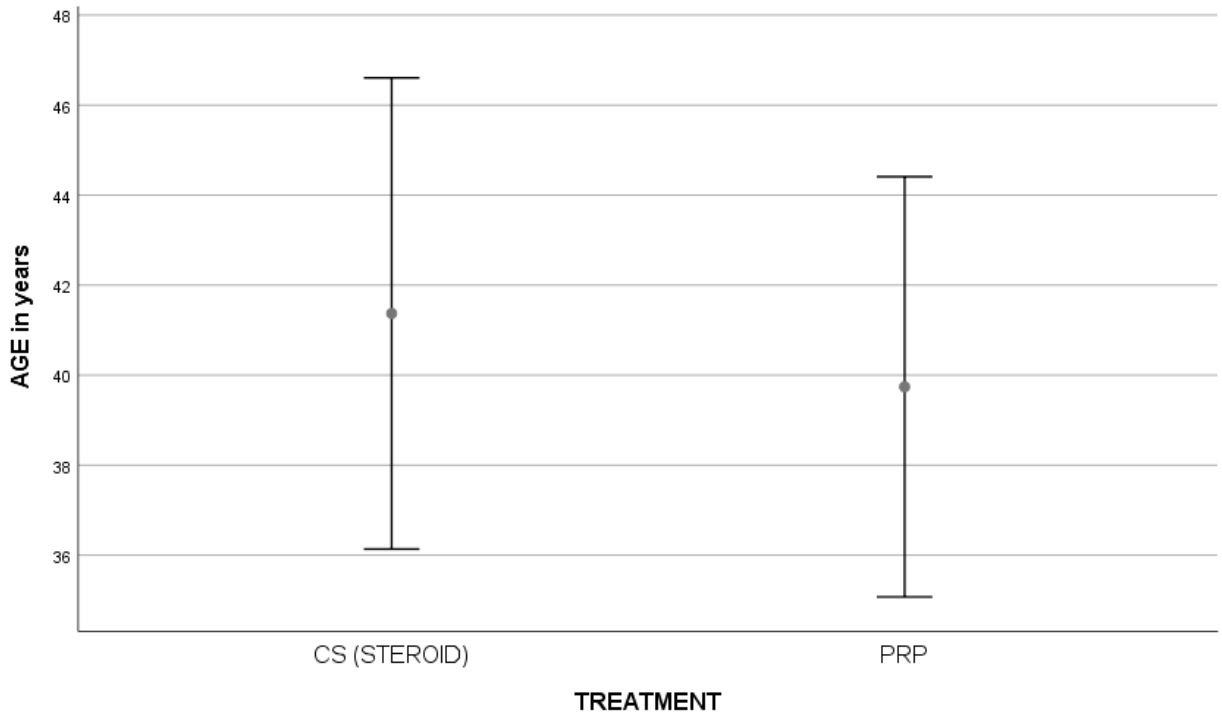


Table 7: Comparison of Gender with Treatment (N=54)

Gender	Treatment		Chi square value	P value
	CS (STEROID) (N=27)	PRP (N=27)		
Male	18 (66.67%)	21 (77.78%)	0.83	0.3621
Female	9 (33.33%)	6 (22.22%)		

In CS treatment, 18 (66.67%) were male and 9 (33.33%) were female. In PRP treatment, 21 (77.78%) were male, and 6 (22.22%) were female. Difference in gender between treatment were found to be insignificant with a P- value of 0.3621. (Table 7 & figure 10)

Figure 10: Cluster bar chart of comparison of Gender with Treatment

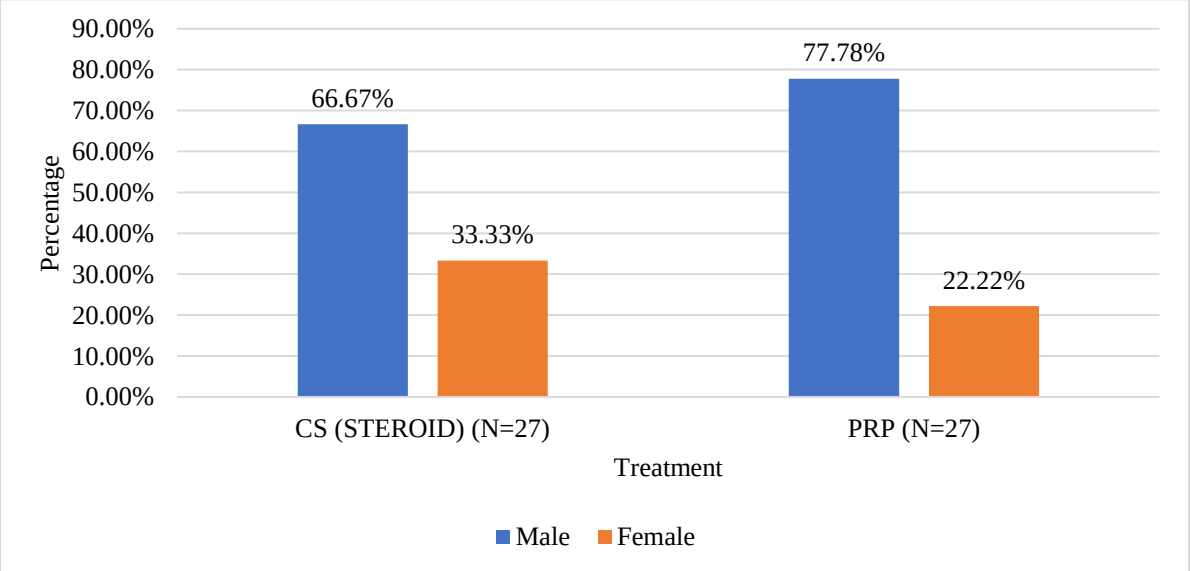


Table 8: Comparison of Side with Treatment (N=54)

Side	Treatment		Chi square value	P value
	CS (STEROID) (N=27)	PRP (N=27)		
Right	16 (59.26%)	12 (44.44%)	1.19	0.2760
Left	11 (40.74%)	15 (55.56%)		

In CS treatment, 16 (59.26%) had right side and 11 (40.74%) had left side. In PRP treatment, 12 (44.44%) had right side and 15 (55.56%) had left side. The difference in side between treatments was found to be insignificant with a P- value of 0.2760. (Table 8 and figure 11)

Figure 11: Stacked bar chart of comparison of Side with Treatment

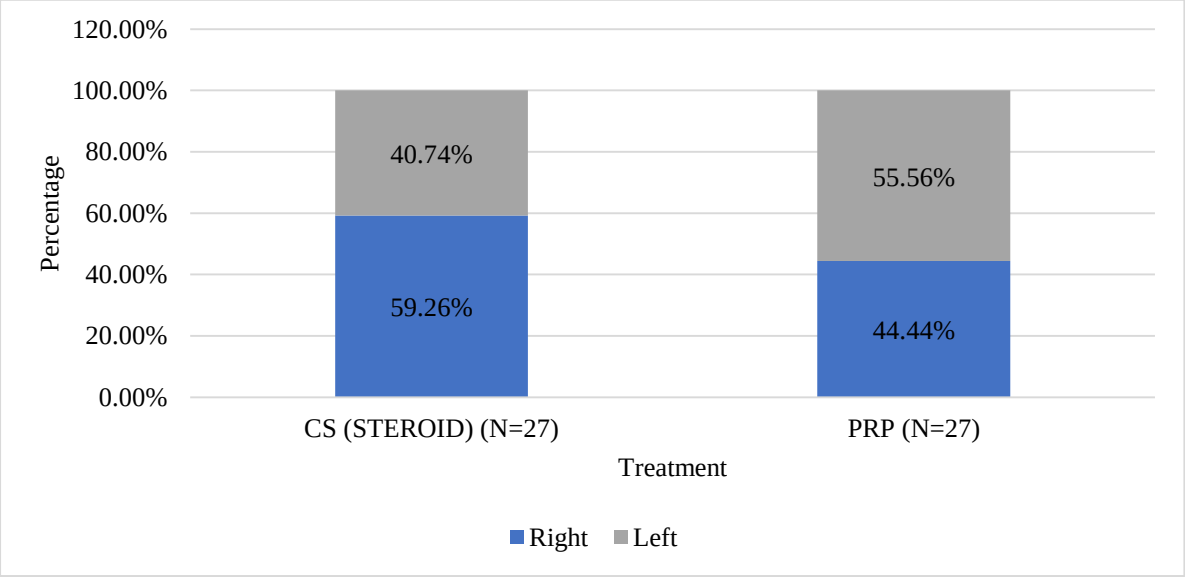


Table 9: Comparison of Diagnosis with Treatment (N=54)

Diagnosis	Treatment		Chi square value	P value
	CS (STEROID) (N=27)	PRP (N=27)		
R-LE	16 (59.26%)	12 (44.44%)	1.19	0.2760
L-LE	11 (40.74%)	15 (55.56%)		

In CS treatment, 16 (59.26%) had R-LE and 11 (40.74%) had L-LE diagnosis. In PRP treatment, 12 (44.44%) had R-LE and 15 (55.56%) had L-LE diagnosis. The difference in diagnosis between treatments was found to be insignificant with a P- value of 0.2760. (Table 9)

Figure 12: Cluster bar chart of comparison of Diagnosis with Treatment

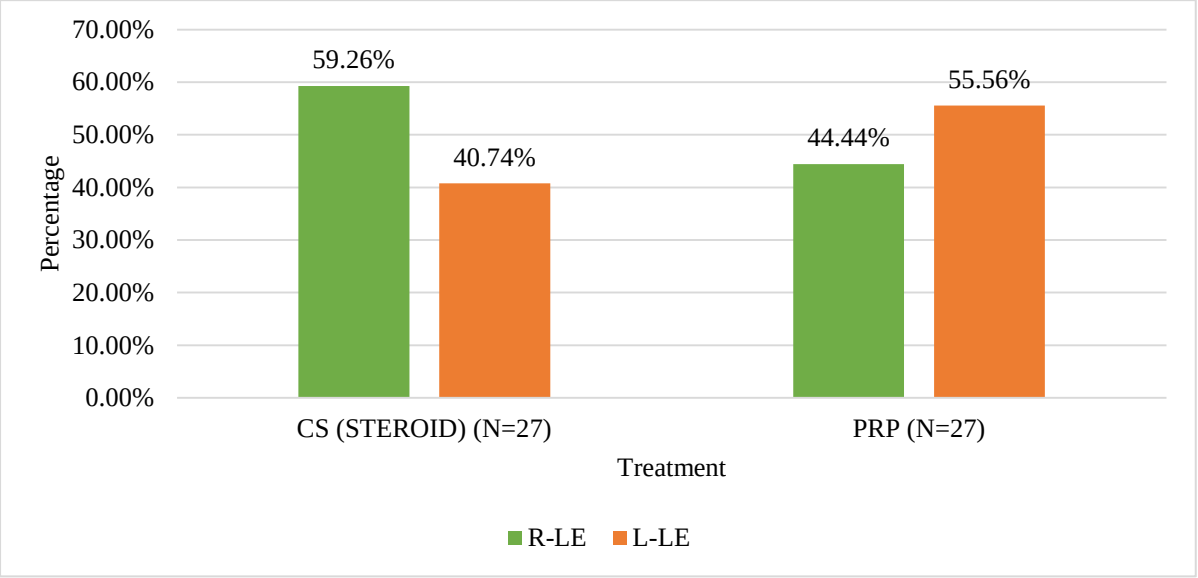


Table 10: Comparison of DM (Diabetes Mellitus) with Treatment (N=54)

Diabetes Mellitus	Treatment		Chi square value	P value
	CS (STEROID) (N=27)	PRP (N=27)		
Yes	6 (22.22%)	5 (18.52%)	0.11	0.7355
No	21 (77.78%)	22 (81.48%)		

The difference in diabetes mellitus between treatments was found to be insignificant with a P-value of 0.7355 with 6 (22.22%) participants had CS treatment and 5 (18.52%) had PRP treatment. (Table 10)

Figure 13: Cluster bar chart of comparison of DM with Treatment

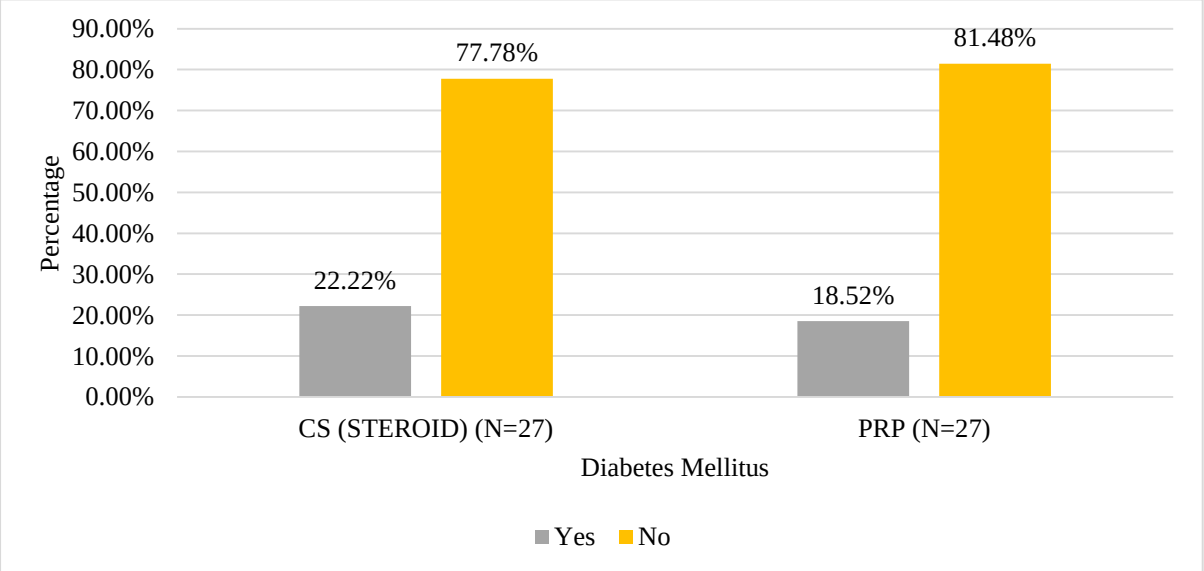


Table 11: Comparison of HTN (Hypertension) with Treatment (N=54)

Hypertension	Treatment		Chi square value	P value
	CS (STEROID) (N=27)	PRP (N=27)		
Yes	3 (11.11%)	4 (14.81%)	0.16	1.0000
No	24 (88.89%)	23 (85.19%)		

The difference in hypertension between treatments was found to be insignificant with a P-value of 1.00 with 3 (11.11%) participants had CS treatment and 4 (14.81%) had PRP treatment. (Table 11)

Figure 14: Stacked bar chart of comparison of HTN with Treatment

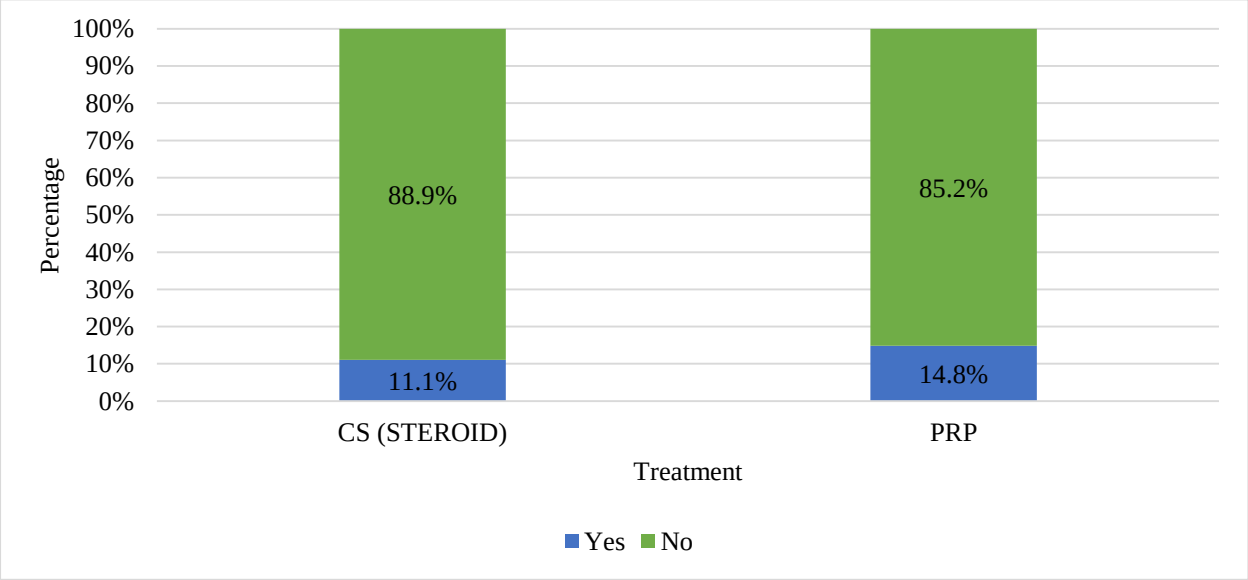


Table 12: Comparison of VAS with Treatment (N=54)

VAS	Treatment		P Value
	CS (STEROID) (N=27)	PRP (N=27)	
Pre injection	8.00(8.0 to 8.0)	8.00(8.0 to 8.0)	0.0041
Post injection	8.00(8.0 to 8.0)	8.00(8.0 to 8.0)	0.0041
1st Month	6.00(5.0 to 6.0)	6.00(6.0 to 7.0)	0.0018
3rd Month	4.00(4.0 to 5.0)	4.00(4.0 to 5.0)	0.2285
6th Month	3.00(3.0 to 4.0)	2.00(2.0 to 3.0)	<0.001

The difference in the VAS scores (pre, post, 1 month, 6months) between treatments was statistically significant (p value <0.05). Difference in the VAS scores 3 months between treatments was statistically insignificant (p value 0.2285). From pre injection to 6 months' time VAS score was reduced in both the treatment groups where in PRP it was reduced more as at 6 months in CS group it was 3 (3 to 4) and in PRP group 2 (2 to 3) i.e., PRP group had better performance. (Table 12 & figure 15)

Figure 15: Line chart of VAS score with treatment

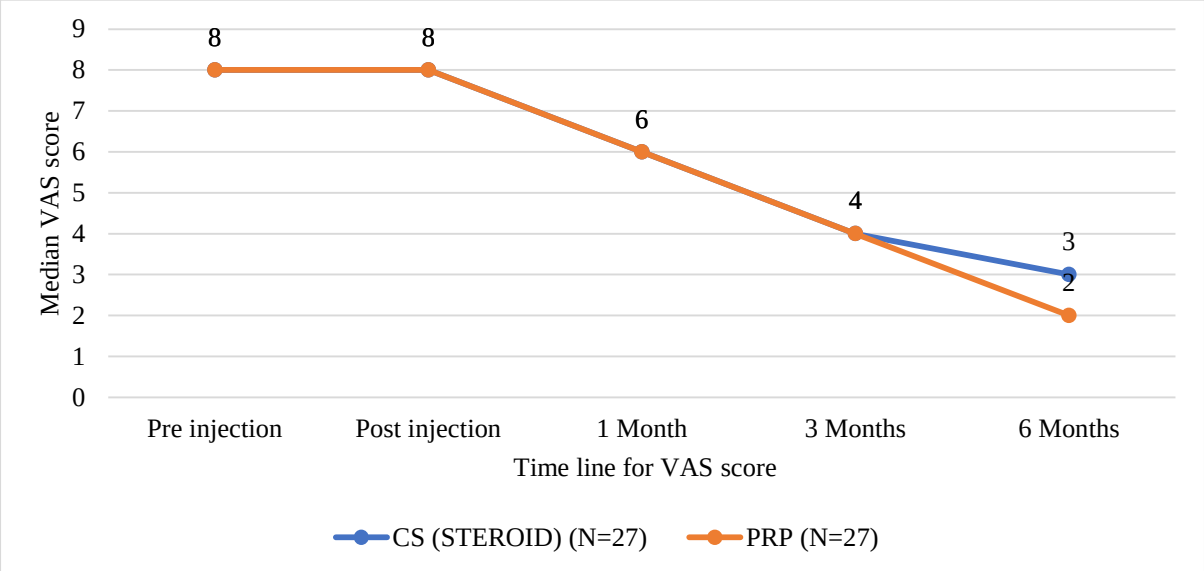


Table 13: Comparison of Quick-Dash with Treatment (N=54)

Quick-Dash	Treatment		P Value
	CS (STEROID) (N=27)	PRP (N=27)	
Pre injection	78.00(76.0 to 80.0)	74.00(69.0 to 77.0)	<0.001
Post injection	78.00(76.0 to 80.0)	74.00(69.0 to 77.0)	<0.001
1st Month	60.00(60.0 to 65.0)	61.00(58.5 to 63.0)	0.4204
3rd Month	45.00(41.0 to 48.5)	50.00(46.0 to 51.0)	0.0339
6th Month	22.00(21.0 to 22.0)	17.00(17.0 to 23.0)	0.1170

The difference in the Quick-Dash at time points (pre, post, 3 months) between treatments was statistically significant (p value <0.05). Difference in Quick-Dash at time point 1 month and 6 months between treatments was statistically insignificant (p value 0.4204, 1170). From pre to 6 months' time Quick Dash score was reduced in both the treatment groups where in PRP group it increased as compared to CS group at 1 and 3 months & at pre, post and 6 months' time period Quick Dash score reduce in PRP group i.e. PRP group had better performance. (Table 13 & figure 16)

Figure 16: Line chart of Quick-Dash with treatment

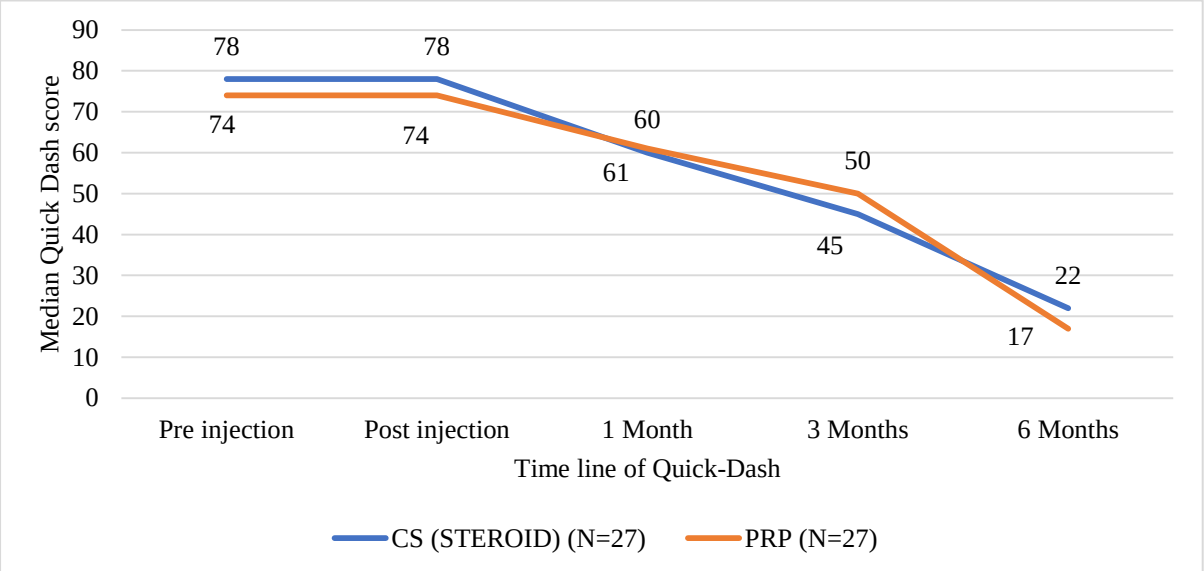


Table 14: Comparison of Oxford Elbow with Treatment (N=54)

Oxford Elbow	Treatment		P Value
	CS (STEROID) (N=27)	PRP (N=27)	
Pre injection	64.00(64.0 to 66.0)	60.00(59.0 to 61.0)	<0.001
Post injection	64.00(64.0 to 66.0)	60.00(59.0 to 61.0)	<0.001
1st Month	74.00(72.0 to 74.0)	68.00(67.0 to 73.0)	<0.001
3rd Month	78.00(78.0 to 80.0)	79.00(78.0 to 80.0)	0.3973
6th Month	82.00(82.0 to 84.0)	93.00(92.0 to 93.0)	<0.001

The difference in the Oxford Elbow at time points (pre, post, 1 month, 6 months) between treatments was statistically significant (p value <0.05). The difference in the Oxford Elbow at 3 months between treatments was statistically insignificant (p value 0.3973). From pre to 6 months' time Oxford Elbow score increased in both the treatment groups & it was high in PRP group compared to CS group which was indicating better performance of PRP group while at pre, post and 1 month time it reduced in PRP group. (Table 14 & figure 17)

Figure 17: Line chart of Oxford Elbow with treatment

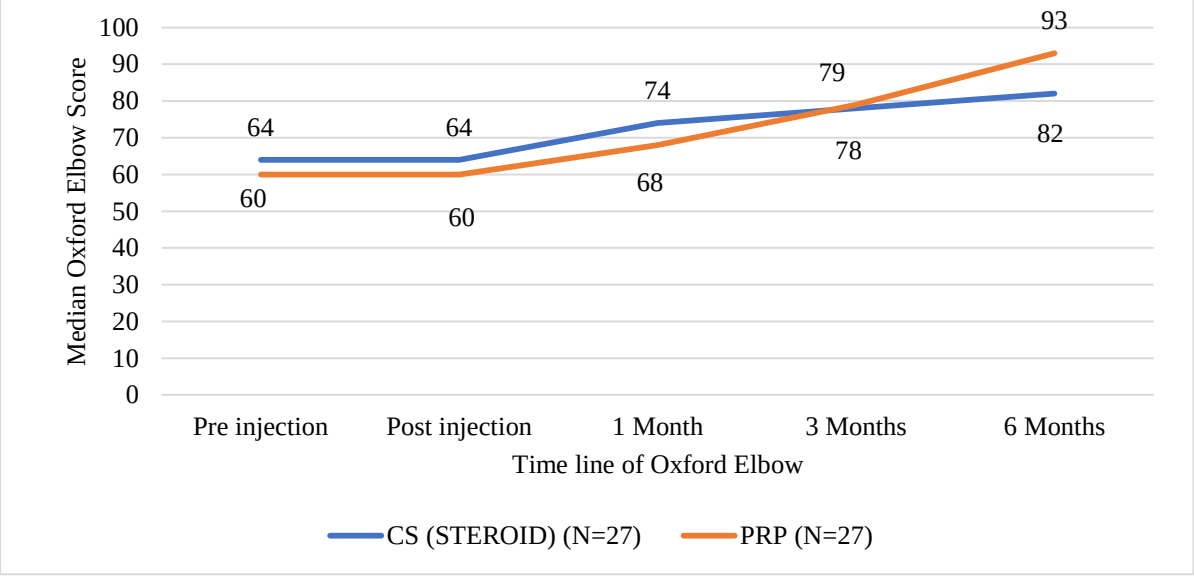
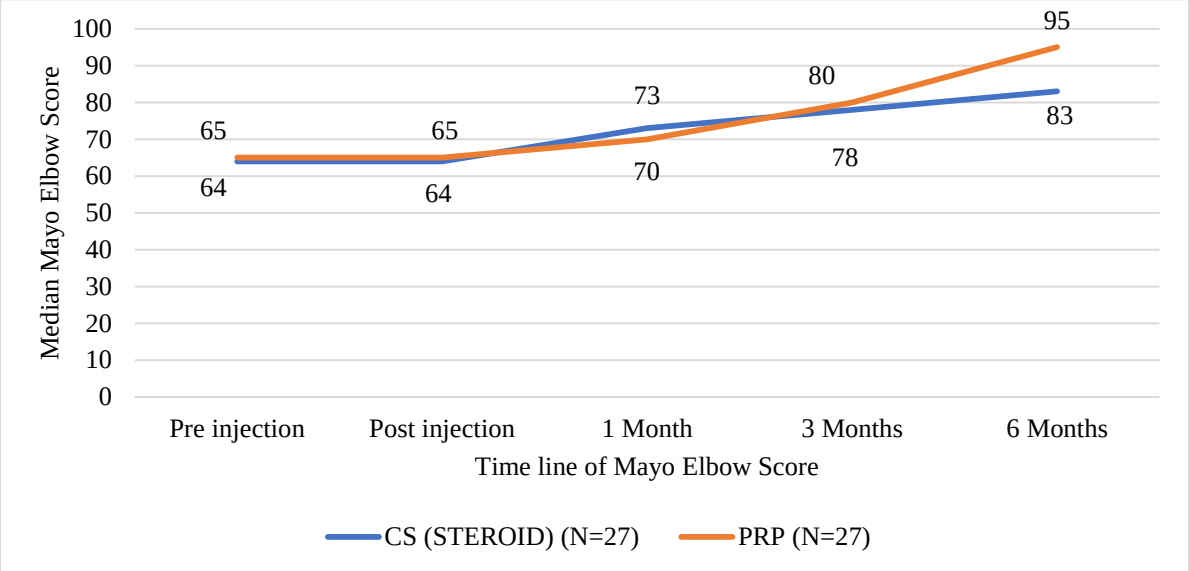


Table 15: Comparison of Mayo Elbow Score with Treatment (N=54)

Mayo Elbow Score	Treatment		P Value
	CS (STEROID) (N=27)	PRP (N=27)	
Pre injection	64.00(62.0 to 64.0)	65.00(60.0 to 65.0)	0.0463
Post injection	64.00(62.0 to 64.0)	65.00(60.0 to 65.0)	0.0463
1st Month	73.00(73.0 to 74.0)	70.00(70.0 to 75.0)	0.0989
3rd Month	78.00(75.0 to 78.0)	80.00(75.0 to 80.0)	<0.001
6th Month	83.00(82.0 to 84.0)	95.00(90.0 to 95.0)	<0.001

The difference in the Mayo Elbow Score at time points (pre, post, 3 months, 6 months) between treatments was statistically significant (p value <0.05). Difference in the Mayo Elbow Score at time point 1 month between treatments was statistically insignificant (p value 0.0989). From pre to 6 months' time Mayo Elbow score increased in both the treatment groups and it was high in PRP group compared to CS group which was indicating better performance of PRP group but only at post Mayo Elbow score it was greater in CS group as compared to PRP group. (Table 15 & figure 18)

Figure 18: Line chart of Mayo Elbow Score with treatment



DISCUSSION

DISCUSSION:

Although lateral epicondylitis is easy to diagnose, the best treatment approach has not been agreed upon. Local steroid injection has been shown to provide consistent and predictable pain relief in the short term.[92] Histological analysis of chronic LE reveals angiofibroblastic and mucoid degeneration secondary to a failure of natural tendon repair mechanism rather than acute inflammation. Platelet-rich plasma (PRP) enhances healing by delivering high concentrations of alpha-granules containing biologically active moieties (such as vascular endothelial growth factor and transforming growth factor-β) to the areas of soft-tissue damage.[5] This study is conducted to compare functional outcome of single dose intralesional PRP injections versus single dose CS injection in chronic lateral epicondylitis treatment. LE patients reporting to outpatient department are assigned to 2 groups with 1 group receiving 2mL single PRP dose and other group receiving approximately 2 mL of corticosteroid, triamcinolone acetonide 40 mg. Randomization ensured that baseline characteristics of 2 groups were comparable in terms of age, gender, weight, height, and BMI (BMI), and pre injection with VAS, Quick DASH score, Oxford elbow score, MEPI. Quick-Dash, Oxford Elbow, Mayo Elbow Score, etc. were considered as primary outcome variables.

54 subjects were included into study with mean age of 41.37 ± 13.24 years the CS group and 39.74 ± 11.80 in PRP group, difference in proportion of age between two study groups was statistically insignificant (p value=0.6350). This is similar to Kurian et al.'s study who had a mean age in the steroid group as 37±4.5 years and among PRP group as 39.4±6.2. [102] Kadam et al.'s study had PRP group consisting of patients with mean age of 34 years and CS group with mean age of 37.20 years.[101] Mean age of patient was 40.9 years and both CS and PRP groups were comparable with respect to age statistically in Japatti et al.'s study.[105]

In our study, both CS and PRP groups had male predominant population with 66.67% males in CS group and 77.78% in PRP group. Difference in proportion of gender between study groups was found to be insignificant with a P-value 0.3621. Kurian et al. also reported a female predominance in their study with 63% females in steroid group and in PRP group, 55% were females.[102] Similarly, Japatti et al.'s study involved 62.5% females and 37.5% males with gender distribution comparable in both steroid and PRP groups.[105] Although some research on gene-based risk factors for lateral epicondylitis has been conducted, the possibility that gender is associated with those investigated genes has not been thoroughly investigated. As a result, the possibility that gender is a cofactor related to genes associated with lateral epicondylitis remains.[114]

Difference in proportion of effected side of treatment between study groups was insignificant with 59.26% having right LE and 40.74% left LE in the CS group and 44.44% right LE and 55.56% left LE in the PRP group, p-value 0.2760. Kurian et al. reported that in their study 58% with symptoms presenting unilaterally and 42% bilaterally.[102] Laterality wise, 70% had right elbow involvement and 30% left elbow in Japatti et al.'s study.[105] In Das et al.'s study, 73.86% showed involvement of right elbow and 26.1% showed involvement of left side. All showed their dominant side to be affected.[107]

Table 16: Comparison of our studies with studies in literature:

SL. No	Study Group	No of Pt's	Mean Age, years	Details of Interventions	Follow-up, months
1	Kurian et al.[15] CS: PRP:	44 22 22	 37 ± 4.5 39.4 ± 6.2	 40 mg Methyl Prednisolone 2.5 mL PRP (both repeated at 4 and 8 weeks)	26 weeks
2	Kadam et al.[17] CS PRP	74 37 37	 34 37.2	 2 mL Triamcinolone 40 mg 4 mL PRP	3, 6, 12
3	Japatti et al.[16] CS PRP	40 20 20		 1 mL Triamcinolone 1 mL PRP	4, 8, 12, 24 weeks
4	Das et al.[18] CS PRP	 100 100	 39.8 39.13	 Triamcinolone Acetonide 1 mL 1 – 2 mL PRP	2, 6 weeks, 3 months
5	Gosens et al[19] CS PRP	 49 51	 47.3 ± 7.8 46.8 ± 8.5		4, 8, 12, 26, 52, 104 weeks
6	Peerbooms et al [20] CS PRP	 49 51	 47.3 ± 7.6 46.9 ± 8.4	 Kenacort 40 mg/mL Triamcinolone Acetonide 1ml 1-2 ml of PRP	4, 8, 12, 26, 52, 104 weeks
7	Merolla et al.[21] Arthroscopic release PRP	 50 51	 46 ± 8.56 47 ± 6.08	 A standard arthroscopic technique with 3 portals: proximal anteromedial, anterolateral, and midlateral 3-5 ml of PRP	2, 4, 8, 12, 24, 52, 104 weeks
8	Current study CS: PRP:	54 27 27	 41.37 ± 13.24 39.74 ± 11.80	 2mL Kenacort 40mg 2 mL of PRP	1, 3, 6

Upon measurement of VAS scores pre injection, immediate post injection, and at 1 month and 6 months post injection between CS ad PRP groups was statistically significant (p value<0.05). At three month follow up, difference in VAS scores between CS and PRP groups was statistically insignificant (p value 0.2285). From pre-injection to 6 months' time

VAS score was reduced in both treatment groups but the PRP group had better resolution of pain compared to CS group. This is consistent with findings of Kurian et al study which found that pvalue for reduction in VAS score for both groups were 0.02 and thus significantly higher for PRP group when compared to steroid group. In Kurian et al study, mean VAS score for steroid group was 7.68±0.945 at start and 2.41±1.652 at the end. It was 7.86±1.082 at the start for PRP group and 1.73±1.932 at 26 weeks. Mean reduction in VAS score for CS group was 5.27±1.2 and 6.14±1.98 for PRP group.[102]

In Kadam et al.'s study, prior to intralesional PRP injection, patients in the PRP group had an average VAS score of 8.061, which improved to 1.424 after a 12-month follow-up. The CS group patients had an average pre-procedure VAS Score of 8, which improved to 2.025 12 months after intralesional corticosteroid administration. At the 6-month follow-up, they had significantly lower VAS for the PRP regimen than for the steroid treatment.[101] Both group of patients showed improvement in pain and functionality, reflected by decreasing VAS scores at 4 and 8 weeks in Japatti et al.' study. However, at 12- and 24-weeks improvement achieved with PRP was much better than steroid. In the steroid group they stopped improving and some patients even started experiencing pain again at 24 weeks.[105]

Concurring with the above, Das et al. discovered that corticosteroid injection had a significantly higher short-term success rate than PRP injection. The mean reduction in VAS score in the PRP group at 2 weeks was 3.17. (From 7.36 to 4.19). The mean reduction in VAS score in the steroid group at 2 weeks was 1.5. (From 6.98 to 5.48). The mean reduction in VAS value after 3 months was 5.66 (from 7.36 to 1.70; 76%) in the PRP injection group and 4.05 (from 6.98 to 2.93; 58%) in the corticosteroid injection group. The mean improvement from PRP injection was significantly greater than that from corticosteroid injection (P0.001).[107]

Upon checking improvement in disability using the Quick-Dash score, the pre injection, immediate postop and three month follow up score between study groups was statistically significant (p value<0.05). Difference in Quick-Dash at 1 and 6 months follow ups between CS and PRP was statistically insignificant with p values 0.4204, 0.1170 respectively, though the PRP group had a better score (17) compared to CS group (22) at six-month follow-up. But to start with the CS group had higher Quick-Dash score 78 preoperatively, whereas the PRP group had 74 preop.

According to Kadam et al study, local CS injection resulted in a lower DASH score than PRP treatment during the short-term follow-up period (3 months), but the PRP regimen resulted in significantly lower DASH scores than the CS treatment at the 6-month follow-up.[101] Japatti et al.'s observations were comparable with our study where they noted that both group of patients showed improvement in pain and functionality, reflected by decreasing DASH scores at 4 and 8 weeks. However, at 12- and 24-weeks improvement achieved with PRP was much better than steroid. In the CS group they stopped improving and some patients even started experiencing pain again at 24 weeks.[105] In Das et al study, mean improvement in DASH score in PRP injection group and corticosteroid injection group was 51.41 (from 61.09 to 9.67; 83%) and 42.01 (from 60.70 to 18.69; 37.70%), respectively. At 2 weeks, however, DASH score was comparable in both groups. PRP injection group improved significantly more than CS injection group (P0.001).[107]

The difference in the Oxford Elbow at preop, immediate postop, 1 month and 6 month follow up between study groups was statistically significant (p value<0.05). Only at three-month follow up, there was not much difference in the Oxford Elbow score between study groups (p value 0.3973). Preop, Oxford Elbow score was high in the CS group at 64 but at six-month follow up they scored less than the PRP group who had only 60 to begin with but had great improvement by the end of six months (93), which is graded excellent. The Oxford

Elbow score in PRP group was better compared to that in CS group at 2 weeks, 6 weeks, 3 months, and 6 months as reported by Gautam et al. from their study with p values 0.001, 0.045, 0.029 and 0.007 respectively. [5] This is comparable to the values noted in our study.

The difference in the Mayo Elbow Score at time points (pre, post, 3 months, six months) between study groups was statistically significant (p value<0.05). At one-month follow up, difference in Mayo Elbow Score between study groups was statistically insignificant (p value0.0989). PRP group started with 65 preop and had excellent improvement at 6-month follow up to 95. CS group started with slightly lesser score of 64 and reached 83 at six-month follow-up, which is graded as fair on the Mayo Elbow score. In Kurian et al.'s study, the improvement in Mayo score was 22.73 ± 7.07 for steroid group and 21.73 ± 10.955 for PRP group. They did not notice much difference in proportion of Mayo score improvement between two groups with p value 0.805.[102]

The study by Kadam et al. found no significant difference between the two arms during the first 6 months of follow-up, but at 12 months, patients managed with local PRP injections outperformed those treated with local corticosteroids. [101] Varshey et alstudy .'s found that after one month, MAYO scores in both treatment groups were comparable, with no statistically significant difference (P = 0.490). At the end of two months, the results were comparable with P = 0.471 for both treatment modalities. MAYO elbow scores improved 54.4% (61.51-95.0) in PRP-treated patients after 6 months, compared to 1.25% improvement (63.92-63.12) in steroid-treated patients, indicating a significant difference (p=0.0001). [103]

Our study showed excellent improvement with PRP treatment compared to the CS at the six-month follow up in VAS, Quick-Dash, Oxford Elbow Score, and Mayo Elbow Scores. There was no difference in the VAS at third month follow up, but overall, pain was treated better with the PRP. On self-reported disability scoring, Quick-Dash, PRP group showed

good score at third month follow up, but the CS group had more severe disability to begin with according to self-reporting. Similarly, upon subjective experience scoring of disability using the Oxford Elbow Score, the PRP group scored excellent at six-month follow up. The PRP group scored excellent on Mayo Elbow Score at six-month follow up whereas the CS group had a good score. PRP has shown to provide significantly more symptomatic improvement than corticosteroids in treatment of LE in Kurian et al.'s study.[102] This could possibly be attributed to the PRP's ability to heal due to the numerous growth factors it contains. As a result, it might be thought of as a good option for treating Chronic Lateral Epicondylitis because, unlike steroid injections, it most likely corrects the underlying pathology.

According to Kadam et al study, PRP is superior to corticosteroid in terms of long-term pain relief and lower recurrence rates. Although both treatments have significant therapeutic effects in treatment of lateral epicondylitis, PRP has been shown to be more effective than corticosteroid.[101] Our study supported these findings. Japatti et al. reiterated our findings that while both CS and PRP are effective for treating LE short-term pain, PRP outperformed steroids in the long-term and sustained management of pain. Steroids carry a higher risk of recurrence than PRP does.[105] According to Das et al PRP injection therapy and local corticosteroid injection therapy are both simple outdoor methods for treating lateral epicondylitis. They agreed with the above research that PRP injection therapy is preferred treatment for lateral epicondylitis due to improved long-term benefits and a high recurrence rate with steroid injection.[107] Gautam et al.'s study also stressed this stating that PRP appeared to enable biological healing of lesion, whereas CS appeared to provide short-term, symptomatic relief but resulted in tendon degeneration.[5]

In contrary to our study Gosen et al. reported that, except for 26 weeks (P =0.029), the corticosteroid group's baseline scores were considerably higher compared to all subsequent

time points (P 0.0001). Pain ratings briefly increased between weeks 8 and 26 (P =0.007). On other hand, during course of trial, PRP group scores increased dramatically when compared with baseline (P 0.002). Over total, there was a statistically significant difference in the mean VAS ratings between the two groups (F1,98 = 6.3, P =0.014). In a study by Gosens et al average DASH disability symptom scores did not differ significantly between intervention groups (P = 0.455). Gosens et al. observed that the treatment of patients with chronic lateral epicondylitis with PRP reduces pain and increases function significantly, exceeding effect of corticosteroid injection even after a follow-up of 2 years. Findings are similar to our study.[100]

Merolla et al. suggested that in his study, at two years follow up, patients with PRP saw a dramatic worsening of their pain. [84] Peerbooms et al. stated that treatment of patients with chronic lateral epicondylitis with PRP reduces pain and significantly increases function, exceeding the effect of corticosteroid injection.[111]

CONCLUSION

CONCLUSIONS:

- Difference in proportion of age, gender, effected side and co-morbidities between the two study groups was statistically not significant.
- From pre injection to 6 months' time VAS score was reduced in both treatment groups but the PRP group had better resolution of pain compared to the CS group.
- The difference in the Quick-Dash at one month and six months follow ups between CS and PRP was statistically insignificant with p values 0.4204, 0.1170 respectively, though the PRP group had a better score of 17 compared to the CS group with 22.
- Oxford Elbow score was 64 for CS group at pre injection but at six-month follow up they scored less than the PRP group who had only 60 to begin with but had great improvement by the end of six months with score of 93, which is graded excellent.
- The PRP group started with score 65 pre injection and had excellent improvement at the six-month follow score of 95. The CS group started with slightly lesser score of 64 and reached to score of 83 at six-month follow-up, which is graded as fair on the Mayo Elbow score.
- We conclude that there was excellent improvement with PRP treatment compared to the CS at the six-month follow up in VAS, Quick-Dash, Oxford and Mayo Elbow Scores.

LIMITATION

LIMITATIONS AND RECOMMENDATIONS:

Our study is prospective randomized control parallel group comparative study done with 54 patients. Our study had certain limitations. A significant limitation is we only compared the effectiveness of PRP and corticosteroids in cohorts of 27 patients each. It is recommended to conduct such a study on a larger cohort. Our study recorded the scores for improvement for six months and longer follow ups are recommended to analyzes lasting effects of PRP. We did not assess the individuals' type of work, level of physical activity, or labor intensity. To assess the relationship between lateral epicondylitis and activity patterns and activity exposure according to occupation, more research is required.

SUMMARY

SUMMARY:

- Without consistently and satisfactorily improving LE, numerous conservative and non-invasive therapies have been performed.
- One of the most frequent invasive procedures, local CS injection has become the gold standard for evaluating novel medicines because it consistently produces positive results.
- PRP is a perfect autologous biological blood-derived treatment that, when injected, produces large concentrations of platelet-derived growth factors that, because of their effects on angiogenesis and collagen synthesis, improve tendon repair.
- Goal of current study is to assess therapeutic effectiveness of PRP and CS in LE epicondylitis patients who present to an outpatient department and are hospitalized as inpatients. Using block randomization technique, the participants are allotted into two treatment groups, single PRP dose and single CS dose.
- Difference in the proportion of age, gender, effected side and co-morbidities between two study groups was statistically not significant. From pre-op to 6 months' post injection period VAS score reduced in both the treatment groups but the PRP group had better resolution of pain compared to the CS group.
- There was excellent improvement with PRP treatment compared to the CS at the six-month follow up in VAS, Quick-Dash, Oxford and Mayo Elbow Scores.
- Our study showed that the effect of CS was only temporary (2–3 months), after which the patients began to feel a slight increase in pain whereas PRP injection as an alternative therapy had longer lasting impact.

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ANNEXURES

ANNEXURES 1

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH,

TAMAKA, KOLAR - 563101.

PATIENT INFORMATION SHEET

STUDY TITLE: ANALYSIS OF FUNCTIONAL OUTCOME OF SINGLE DOSE INTRA LESIONAL PLATELET RICH PLASMA INJECTION VERSUS SINGLE DOSE CORTICOSTEROID INJECTION IN THE TREATMENT OF CHRONIC LATERAL EPICONDYLITIS – A PROSPECTIVE COMPARATIVE STUDY

Study location: R L Jalappa Hospital and Research Centre attached to Sri Devaraj Urs Medical College, Tamaka, Kolar.

Details-Patients aged between 20 and 60 years diagnosed having lateral epicondylitis who visit to the department of Orthopedics to R. L. Jalappa Hospital will be included in this study in one of two groups. Group A and Group B after randomization each patient will receive 2ml of single intralesional PRP injection or 2ml of single intralesional injection of corticosteroid injections under strict aseptic precautions in operation theater. This a novel treatment for lateral epicondylitis which is under investigational stage not yet standardized, yet the sampling of this injection has been well established, by the PRP injection for orthopedic usage in scientific literatures. Patients in this study will have to undergo routine investigations and x ray of affected elbow AP view and lateral view. This intra-articular PRP injection can have the following complications like increase pain in the Elbow, swelling, erythema, difficulty in elbow range of motions, infection etc.

Please read the following information and discuss with your family members. You can ask any question regarding the study. If you agree to participate in the study we will collect information (as per proforma) from you or a person responsible for you or both. Relevant history will be taken. This information collected will be used only for dissertation and publication.

All information collected from you will be kept confidential and will not be disclosed to any outsider. Your identity will not be revealed. This study has been reviewed by the Institutional Ethics Committee and you are free to contact the secretary of the Institutional Ethics Committee. There is no compulsion to agree to this study. The care you will get will not change if you don't wish to participate. You are required to sign/ provide thumb impression only if you voluntarily agree to participate in this study.

For further information contact

DR. VYSHNAV SRINIVASAN

First year post graduate,

Department of ORTHOPAEDICS,

SDUMC, Tamaka, Kolar.

CONTACT NO:9591356264

ANNEXURE 2

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, TAMAKA, KOLAR - 563101

INFORMED CONSENT FORM

I/we the patient attenders have been explained about outpatient's condition i.e., lateral epicondylitis and the need for the procedure i.e., single intra lesional platelet rich plasma (PRP) injection or single intra lesional corticosteroid injection in the treatment of lateral epicondylitis.

The procedure and complications (Pain at injection site, Infection, Allergic reaction, Blood clot, Skin discoloration) associated with this procedure i.e., single intra lesional platelet rich plasma (PRP) injection or single intra lesional corticosteroid injection have been explained to me in my own understandable language.

I have been explained regarding the study design and I am participating in the study with my willful consent in group A or group B. I have been also explained by the investigator that I am free to participate in the study, I can withdraw from the study at any point of time and I would continue to receive the standard care and treatment in this hospital as long as I wish to receive the treatment.

I/we the patient and the patient attenders hold the full responsibility for the procedure and the further consequences. I will not hold any treating doctor, nursing staff and hospital management for any untoward consequences.

I hereby give my consent for the same.

SIGNATURE OF THE PATIENT: SIGNTURE OF DOCTOR:

WITTNESS:

1.

2.

ANNEXURE 3

ರೋಗಿ ಮಾಹಿತಿ ಹಾಳೆ

ಅಧ್ಯಯನ ಶೀರ್ಷಿಕೆ: ಸಿಂಗಲ್ ಡೋಸ್ನ ಕ್ರಿಯಾತ್ಮಕ ಕಾರ್ಯಾಚರಣೆಯ ವಿಶ್ಲೇಷಣೆ ಇಂಟ್ರಾ ಲೀಷನಲ್ ಪ್ಲೇಟ್ಲೆಟ್ ರಿಚ್ ಪ್ಲಾಸ್ಮಾ ಚುಚ್ಚುಮದ್ದು ವರ್ಸಸ್ ಸಿಂಗಲ್ ಡೋಸ್ ಕಾರ್ಟಿಕೊಸ್ಟೆರಾಯ್ಡ್ ಚುಚ್ಚುಮದ್ದು ಕ್ರೋನಿಕ್ ಲ್ಯಾಟರಲ್ ಎಪಿಕಾಂಡಿಲೈಟಿಸ್ ಚಿಕಿತ್ಸೆಯ, ಕಾರ್ಯಾತ್ಮಕ ಫಲಿತಾಂಶದ ವಿಶ್ಲೇಷಣೆ - ಒಂದು ಸಂಭವನೀಯ ತುಲನಾತ್ಮಕ ಅಧ್ಯಯನ

ಅಧ್ಯಯನ ಸ್ಥಳ: ಕೋಲಾರದ ತಮಾಕ, ಶ್ರೀ ದೇವರಾಜ ಅರಸು ವೈದ್ಯಕೀಯ ಕಾಲೇಜಿಗೆ ಹೊಂದಿಕೊಂಡಿರುವ ಆರ್.ಎಲ್.ಜಾಲಪ್ಪ ಆಸ್ಪತ್ರೆ ಮತ್ತು ಸಂಶೋಧನಾ ಕೇಂದ್ರ.

ವಿವರಗಳು-

ಮೂಳೆಚಿಕಿತ್ಸಕ ವಿಭಾಗಕ್ಕೆ ಭೇಟಿ ನೀಡುವ 20 ರಿಂದ 60 ವರ್ಷ ವಯಸ್ಸಿನ ರೋಗಿಗಳು ಲ್ಯಾಟರಲ್ ಎಪಿಕೋಂಡಿಲೈಟಿಸ್ ನಿಂದ ಮೂಳೆಚಿಕಿತ್ಸಕರ ಗೆ ಭೇಟಿ ನೀಡುವರು. ಜಾಲಪ್ಪ ಆಸ್ಪತ್ರೆಯನ್ನು ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಎರಡು ಗುಂಪುಗಳಲ್ಲಿ ಒಂದು ಗುಂಪಿಗೆ ಸೇರಿಸಲಾಗುವುದು. A ಮತ್ತು Group B ಯಾದೃಚ್ಛಿಕೀಕರಣದ ನಂತರ ಪ್ರತಿ ರೋಗಿಗೆ ಆಪರೇಶನ್ ಥಿಯೇಟರ್ನಲ್ಲಿ ಕಟ್ಟುನಿಟ್ಟಿನ ಅಸೆಪ್ಟಿಕ್ ಮುನ್ನೆಚ್ಚರಿಕೆಯ ಅಡಿಯಲ್ಲಿ, ಪ್ರತಿ ರೋಗಿಗೆ 2ml ಸಿಂಗಲ್ ಇಂಟ್ರಾಲೆಷನಲ್ ಪಿಆರ್ ಪಿ ಇಂಜೆಕ್ಷನ್ ಅಥವಾ ಕಾರ್ಟಿಕೊಸ್ಟೆರಾಯ್ಡ್ ಚುಚ್ಚುಮದ್ದುಗಳ 2ml ಇಂಜೆಕ್ಷನ್ ಅನ್ನು ಸ್ವೀಕರಿಸಲಾಗುತ್ತದೆ. ಇದು ಪರಿಶೋಧನಾ ಹಂತದಲ್ಲಿರುವ ಲ್ಯಾಟರಲ್ ಎಪಿಕೋಂಡೈಲಿಟಿಸ್ ನ ಒಂದು ವಿನೂತನ ಚಿಕಿತ್ಸೆಯಾಗಿದೆ, ಆದರೂ ಈ ಚುಚ್ಚುಮದ್ದನ್ನು ಇನ್ನೂ ಪ್ರಮಾಣೀಕರಿಸಲಾಗಿಲ್ಲ, ವೈಜ್ಞಾನಿಕ ಸಾಹಿತ್ಯದಲ್ಲಿ ಆರ್ಥೋಪೆಡಿಕ್ ಬಳಕೆಗಾಗಿ ಪಿಆರ್ ಪಿ ಇಂಜೆಕ್ಷನ್ ನಿಂದ ಈ ಚುಚ್ಚುಮದ್ದನ್ನು ಚೆನ್ನಾಗಿ ಸ್ಥಾಪಿಸಲಾಗಿದೆ. ಈ ಅಧ್ಯಯನದಲ್ಲಿ ರೋಗಿಗಳು ನಿಯಮಿತ ತಪಾಸಣೆಗಳಿಗೆ ಒಳಗಾಗಬೇಕಾಗುತ್ತದೆ ಮತ್ತು ಬಾಧಿತ ಮೊಣಕೈ AP ವೀಕ್ಷಣೆ ಮತ್ತು ಪಾರ್ಶ್ವ ನೋಟದ ಎಕ್ಸ್ ರೇ ಗೆ ಒಳಗಾಗಬೇಕಾಗುತ್ತದೆ. ಈ ಇಂಟ್ರಾ ಆರ್ಟಿಕ್ಯುಲರ್ ಪಿಆರ್ ಪಿ ಇಂಜೆಕ್ಷನ್ ನಲ್ಲಿ ಮೊಣಕೈನೋವು, ಊತ, ಎರಿಥಮಾ, ಮೊಣಕೈ ಚಲನೆಗಳ ಶ್ರೇಣಿಯಲ್ಲಿ ತೊಂದರೆ, ಸೋಂಕು ಇತ್ಯಾದಿ ಈ ಕೆಳಗಿನ ತೊಡಕುಗಳನ್ನು ಹೊಂದಬಹುದು.

ದಯವಿಟ್ಟು ಈ ಕೆಳಗಿನ ಮಾಹಿತಿಯನ್ನು ಓದಿ ಮತ್ತು ನಿಮ್ಮ ಕುಟುಂಬ ಸದಸ್ಯರೊಂದಿಗೆ ಚರ್ಚಿಸಿ. ಅಧ್ಯಯನಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ನೀವು ಯಾವುದೇ ಪ್ರಶ್ನೆಯನ್ನು ಕೇಳಬಹುದು. ನೀವು ಅಧ್ಯಯನದಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳಲು ಒಪ್ಪಿದರೆ, ನಾವು ನಿಮ್ಮಿಂದ ಅಥವಾ ನಿಮಗೆ ಅಥವಾ ಎರಡಕ್ಕೂ ಜವಾಬ್ದಾರರಾಗಿರುವ ವ್ಯಕ್ತಿಯಿಂದ (ಪ್ರೊಫೋರ್ಮಾ ಪ್ರಕಾರ) ಮಾಹಿತಿಯನ್ನು ಸಂಗ್ರಹಿಸುತ್ತೇವೆ. ಸಂಬಂಧಪಟ್ಟ ಇತಿಹಾಸವನ್ನು ತೆಗೆದುಕೊಳ್ಳಲಾಗುವುದು. ಸಂಗ್ರಹಿಸಿದ ಮಾಹಿತಿಯನ್ನು ಕೇವಲ ಲೇಖನ ಮತ್ತು ಪ್ರಕಟಣೆಗಾಗಿ ಮಾತ್ರ ಬಳಸಲಾಗುತ್ತದೆ.

ನಿಮ್ಮಿಂದ ಸಂಗ್ರಹಿಸಿದ ಎಲ್ಲಾ ಮಾಹಿತಿಯನ್ನು ಗೌಪ್ಯವಾಗಿಇಡಲಾಗುತ್ತದೆ ಮತ್ತು ಯಾವುದೇ ಹೊರಗಿನವರಿಗೆ ಬಹಿರಂಗಪಡಿಸಲಾಗುವುದಿಲ್ಲ. ನಿಮ್ಮ ಗುರುತನ್ನು ಬಹಿರಂಗಪಡಿಸುವುದಿಲ್ಲ. ಈ ಅಧ್ಯಯನವನ್ನು ಸಾಂಸ್ಥಿಕ ನೀತಿ ಶಾಸ್ತ್ರ, ಸಮಿತಿ ಪರಿಶೀಲಿಸಿದೆ ಮತ್ತು ಸಾಂಸ್ಥಿಕ ನೀತಿ ಸಮಿತಿಯ ಕಾರ್ಯದರ್ಶಿಯನ್ನು ಸಂಪರ್ಕಿಸಲು ನೀವು ಸ್ವತಂತ್ರರು. ಈ ಅಧ್ಯಯನವನ್ನು ಒಪ್ಪಲು ಯಾವುದೇ ಒತ್ತಾಯವಿಲ್ಲ. ನೀವು ಭಾಗವಹಿಸಲು ಬಯಸದಿದ್ದರೆ, ನೀವು ಪಡೆಯುವ ಆರೈಕೆಯು ಬದಲಾಗುವುದಿಲ್ಲ. ನೀವು ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ಸ್ವಇಚ್ಛೆಯಿಂದ ಒಪ್ಪಿಕೊಂಡರೆ ಮಾತ್ರ ನೀವು ಸಹಿ ಮಾಡಬೇಕು/ ಹೆಬ್ಬೆಟ್ಟು ಗುರುತು ನೀಡಬೇಕು.

ಹೆಚ್ಚಿನ ಮಾಹಿತಿಗೆ ಸಂಪರ್ಕಿಸಿ

ಡಾ.ವೈಷ್ಣವ್ ಶ್ರೀನಿವಾಸನ್

ಮೊದಲ ವರ್ಷದ ಸ್ನಾತಕೋತ್ತರ ಪದವಿ, .

ಮೂಳೆಚಿಕಿತ್ಸಕ ವಿಭಾಗ,

ಎಸ್ ಡಿಯುಎಂಸಿ, ತಾಮಕ,ಕೋಲಾರ .

ಸಂಪರ್ಕ ಸಂಖ್ಯೆ:9591356264

ಮಾಹಿತಿ ಸಮ್ಮತಿ ನಮೂನೆ

ನಾನು / ನಾವು ರೋಗಿಯ ಪಾಲ್ಗೊಳ್ಳುವವರಿಗೆ ಹೊರರೋಗಿಗಳ ಸ್ಥಿತಿಯ ಬಗ್ಗೆ ವಿವರಿಸಲಾಗಿದೆ, ಅಂದರೆ, ಲ್ಯಾಟರಲ್ ಎಪಿಕಾಂಡೈಲೈಟಿಸ್ ಮತ್ತು ಕಾರ್ಯವಿಧಾನದ ಅವಶ್ಯಕತೆ, ಅಂದರೆ, ಪಾರ್ಶ್ವ ಎಪಿಕಾಂಡೈಲೈಟಿಸ್ ಚಿಕಿತ್ಸೆಯಲ್ಲಿ ಸಿಂಗಲ್ ಇಂಟ್ರಾ ಲೆಸನಲ್ ಪ್ಲೇಟ್‌ಲೆಟ್ ರಿಚ್ ಪ್ಲಾಸ್ಮಾ (ಪಿಆರ್‌ಪಿ) ಇಂಜೆಕ್ಷನ್ ಅಥವಾ ಸಿಂಗಲ್ ಇಂಟ್ರಾ ಲೆಸನಲ್ ಕಾರ್ಟಿಕೊಸ್ಟೆರಾಯ್ಡ್ ಇಂಜೆಕ್ಷನ್.

ಈ ಕಾರ್ಯವಿಧಾನಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ವಿಧಾನ ಮತ್ತು ತೊಡಕುಗಳು (ನೋವು ಚುಚ್ಚುಮದ್ದಿನ ಸ್ಥಳ, ಸೋಂಕು, ಅಲರ್ಜಿಯ ಪ್ರತಿಕ್ರಿಯೆ, ರಕ್ತ ಹೆಪ್ಪುಗಟ್ಟುವಿಕೆ, ಚರ್ಮದ ಬಣ್ಣ) ಅಂದರೆ, ಸಿಂಗಲ್ ಇಂಟ್ರಾ ಲೆಸನಲ್ ಪ್ಲೇಟ್‌ಲೆಟ್ ರಿಚ್ ಪ್ಲಾಸ್ಮಾ (ಪಿಆರ್‌ಪಿ) ಇಂಜೆಕ್ಷನ್ ಅಥವಾ ಸಿಂಗಲ್ ಇಂಟ್ರಾ ಲೆಸನಲ್ ಕಾರ್ಟಿಕೊಸ್ಟೆರಾಯ್ಡ್ ಇಂಜೆಕ್ಷನ್ ಅನ್ನು ನನ್ನಲ್ಲಿ ವಿವರಿಸಲಾಗಿದೆ ಸ್ವಂತ ಅರ್ಥವಾಗುವ ಭಾಷೆ.

ಅಧ್ಯಯನದ ವಿನ್ಯಾಸದ ಬಗ್ಗೆ ನನಗೆ ವಿವರಿಸಲಾಗಿದೆ ಮತ್ತು ಗುಂಪು ಎ ಅಥವಾ ಗುಂಪು ಬಿ ಯಲ್ಲಿ ನನ್ನ ಉದ್ದೇಶಪೂರ್ವಕ ಒಪ್ಪಿಗೆಯೊಂದಿಗೆ ನಾನು ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುತ್ತಿದ್ದೇನೆ. ನಾನು ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ಮುಕ್ತನಾಗಿದ್ದೇನೆ, ನಾನು ಅಧ್ಯಯನದಿಂದ ಹಿಂದೆ ಸರಿಯಬಹುದು ಯಾವುದೇ ಸಮಯದಲ್ಲಿ ಮತ್ತು ನಾನು ಚಿಕಿತ್ಸೆಯನ್ನು ಸ್ವೀಕರಿಸಲು ಬಯಸುವವರೆಗೂ ನಾನು ಈ ಆಸ್ಪತ್ರೆಯಲ್ಲಿ ಗುಣಮಟ್ಟದ ಆರೈಕೆ ಮತ್ತು ಚಿಕಿತ್ಸೆಯನ್ನು ಪಡೆಯುವುದನ್ನು ಮುಂದುವರಿಸುತ್ತೇನೆ.

ನಾನು / ನಾವು ರೋಗಿ ಮತ್ತು ರೋಗಿಯ ಪರಿಚಾರಕರು ಕಾರ್ಯವಿಧಾನದ ಸಂಪೂರ್ಣ ಜವಾಬ್ದಾರಿಯನ್ನು ಮತ್ತು ಮುಂದಿನ ಪರಿಣಾಮಗಳನ್ನು ಹೊಂದಿರುತ್ತೇವೆ. ಯಾವುದೇ ಅಹಿತಕರ ಪರಿಣಾಮಗಳಿಗೆ ನಾನು ಚಿಕಿತ್ಸೆ ನೀಡುವ ವೈದ್ಯರು, ಶುಶ್ರೂಷಾ ಸಿಬ್ಬಂದಿ ಮತ್ತು ಆಸ್ಪತ್ರೆ ನಿರ್ವಹಣೆಯನ್ನು ಹಿಡಿದಿಡುವುದಿಲ್ಲ.

ಇದಕ್ಕಾಗಿ ನಾನು ನನ್ನ ಸಮ್ಮತಿಯನ್ನು ನೀಡುತ್ತೇನೆ.

ರೋಗಿಯ ಸಹಿ: ವೈದ್ಯರ ಸಹಿ:

ಸಾಕ್ಷಿ::

1.

2.

ANNEXURE 4

PROFORMA

Name	:	Case no	:
Age	:	Ip/op no	:
Sex	:	DOB	:
Address	:	Date	:

Phone no:

Chief complaints:

History of presenting illness:

Past history:

Family history:

Personal history:

General physical examination:

Vital signs:

Systemic examination

BP -	CVS-
RR -	RS-
PR -	PA-
Temp-	CNS-

LOCAL EXAMINATION OF ELBOW:

Side	: Left/Right/Bilateral
Deformity	: Present/Absent
Swelling	: Present/Absent
Tenderness	: Present/Absent
ROM @ elbow	: Full / Restricted
Distal sensation	: Present/Absent
Distal pulsation	: Palpable/Absent

COZEN'S TEST : Positive/Negative

MILL'S MANEUVER : Positive / Negative

X ray of elbow (right / left /both):-

Routine:

Hb%	RBS
TC	Blood urea
DC	Serum creatinine
HIV	HBsAg
HCV	Blood group

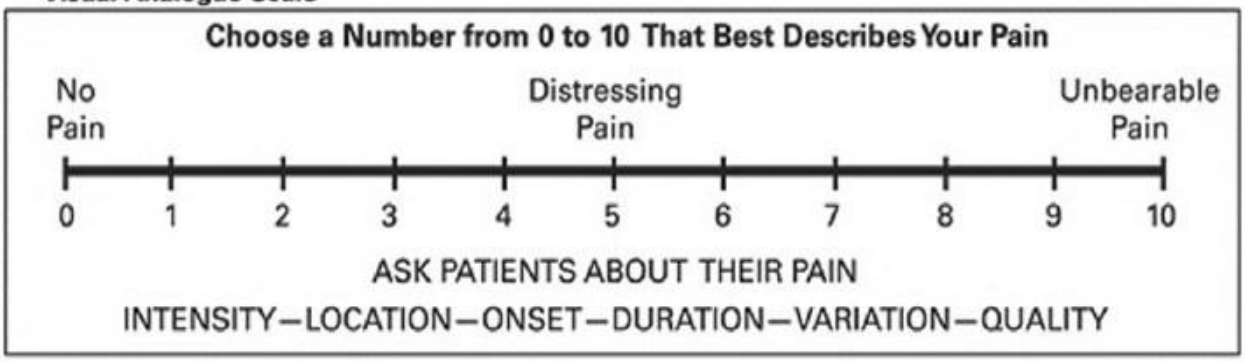
Diagnosis:

Treatment: Intra Lesional platelet rich plasma injection / Intra Lesional corticosteroid injection.

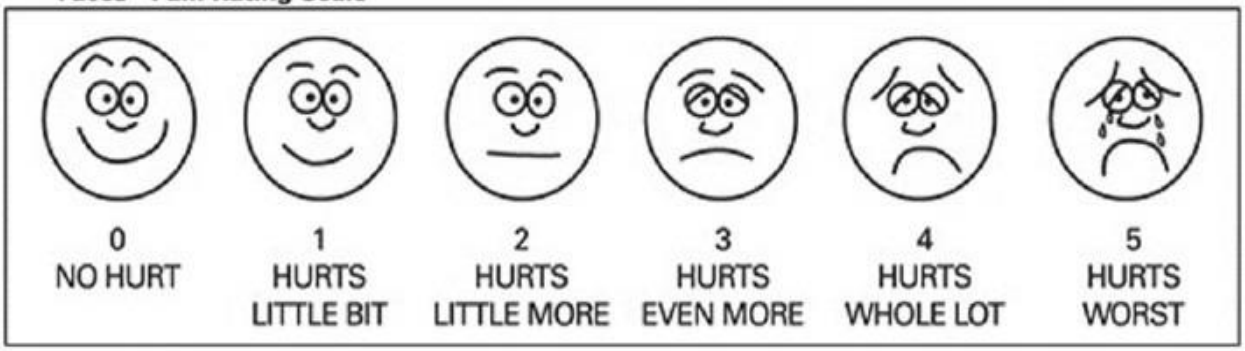
1) **VAS scoring during follow ups: -**

Figures: Tools Commonly Used to Rate Pain

Visual Analogue Scale



"Faces" Pain Rating Scale



2) MAYO ELBOW PERFORMANCE SCORE

Table I Mayo Elbow Performance Score[7,9]

	No. of points*
Pain (45 points)	
None	45
Mild	30
Moderate	15
Severe	0
Range of motion (20 points)	
>100° flexion arc	20
50°-100° flexion arc	15
<50° flexion arc	5
Stability (10 points)	
Stable	10
Mild instability (<10° of varus-valgus laxity)	5
Gross instability (≥10° of varus-valgus laxity)	0
Daily function (25 points)	
Combing hair	5
Feeding oneself	5
Hygiene	5
Putting on shirt	5
Putting on shoes	5
Maximum possible (total)	100

* The outcome is rated as follows: excellent, 90 to 100 points; good, 75 to 89 points; fair, 60 to 74 points; or poor, less than 60 points.

3)Oxford Elbow Score

Clinician's name (or ref) _____ **Patient's name (or ref)** _____

Please answer the following 12 multiple choice questions.

1. Have you had any difficulty lifting things in your home, such as putting out the rubbish, because of your elbow problem?
○ No difficulty
○ A little bit of difficulty
○ Moderate difficulty
◉ Extreme difficulty
○ Impossible to do

7.Have you been troubled by pain from your elbow at night?
○ No, not at all
○ 1 or 2 nights
○ Some nights
○ Most nights
○ Every night

2. Have you had difficulty carrying bags of shopping because of your elbow problem?
○ No difficulty
○ A little bit of difficulty
○ Moderate difficulty
○ Extreme difficulty
○ Impossible to do

8. How often has your elbow pain interfered with your sleeping?
○ No, not at all
○ Occasionally
○ Some days
○ Most days
○ Every day

3. Have you had any difficulty washing yourself all over, because of our elbow problem?
○ No difficulty
○ A little bit of difficulty
○ Moderate difficulty
○ Extreme difficulty
○ Impossible to do

9. How much has your elbow problem interfered with your usual work or everyday activities?
○ No, not at all
○ A little bit
○ Moderately
○ Greatly
○ Totally

4. Have you had any difficulty dressing yourself, because of your elbow problem?
○ No difficulty
○ A little bit of difficulty
○ Moderate difficulty
○ Extreme difficulty
○ No, impossible

10. Has your elbow problem limited your ability to take part in leisure activities that you enjoy doing?
○ No, not at all
○ Occasionally
○ Some days
○ Most days
○ All of the time

5. Have you felt that your elbow problem is "controlling your life"?	11. How would you describe the worst pain you had from your elbow?
No, not at all	No Pain
Occasionally	Mild pain
Some days	Moderate pain
Most days	Severe pain
Every day	Unbearable

6. How much has your elbow problem been "on your mind"?	12. How would you describe the pain you usually had from your elbow?
No, not at all	No pain
A little of the time	Mild pain
Some of the time	Moderate pain
Most of the time	Severe pain
All of the time	Unbearable

4) Quick DASH score

*Quick*DASH-9

INSTRUCTIONS: This questionnaire asks about your symptoms as well as your ability to perform certain activities. Please answer *every question*, based on your condition in the last week, by circling the appropriate number. If you did not have the opportunity to perform an activity in the past week, please make your *best estimate* of which response would be the most accurate. It doesn't matter which hand or arm you use to perform the activity; please answer based on your ability regardless of how you perform the task.

Rate your ability to do the following activities in the last week by circling the number below the appropriate response.

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. Open a tight or new jar.	0	1	2	3	4
2. Do heavy household chores (e.g., wash walls, floors).	0	1	2	3	4
3. Carry a shopping bag or briefcase.	0	1	2	3	4
4. Wash your back.	0	1	2	3	4
5. Use a knife to cut food.	0	1	2	3	4
6. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).	0	1	2	3	4

	NOT AT ALL	SLIGHTLY	MODERATELY	QUITE A BIT	EXTREMELY
7. During the past week, *to what extent* has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups?	0	1	2	3	4

	NOT AT ALL	SLIGHTLY LIMITED	MODERATELY LIMITED	VERY LIMITED	UNABLE
8. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem?	0	1	2	3	

	NONE	MILD	MODERATE	SEVERE	EXTREME
9. Arm, shoulder or hand pain.	0	1	2	3	4

A *Quick*DASH-9 score may not be calculated if there is greater than 1 missing item.

***Quick*DASH-9 SCORE = [(sum) x 1.1] x 5/2, a missing response is added as the average of the remaining.**

	VAS	Quick DASH	OXFORD ELBOW	MODIFIED MAYO
Pre procedure				
Post procedure immediate				
1st month				
3rd months				
6th months				

COMPLICATION IF ANY:

ASSESSMENT OF RESULT:

Signature of candidate: **Signature of Guide:** **Signature of co-Guide**

ANNEXURE 5

Figure 19: Centrifugation machine

Blood bag centrifugation machine, initially blood will be centrifuged using a light spin at 2630 Revolutions Per Minute (RPM) for 3 minutes and 1500RPM for another 15 minutes to sediment the RBCs and WBCs

Figure 20: Double blood bag used for PRP collection.

Figure 21: Blood separation

Figure 22: PRP separated in blood bag

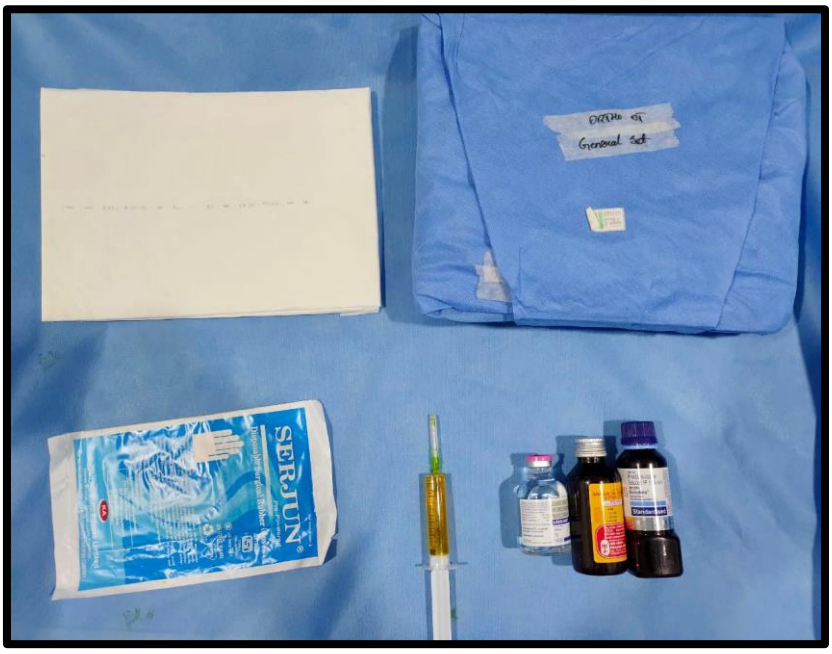


Figure 23: Sterile kit for Intralesional PRP injection

Figure 24: Under aseptic precautions, 2ml of IL-PRP is injected to point of maximum tenderness.

Figure 25: Sterile kit for Corticosteroid injection

Figure 26: Under aseptic precautions, 2ml of IL-CS is injected to point of maximum tenderness.

MASTER CHART

ANNEXURE 6

KEY TO MASTER CHART

M	**MALE**
F	**FEMALE**
UHID	**UNIQUE HOSPITAL IDENTIFICATION**
S.NO	**SERIAL NUMBER**
PRP	**PLATELET RICH PLASMA**
CS	**CORTICOSTEROID**
VAS	**VISUAL ANALOGUE SCALE**
DASH	**DISABILITY OF THE ARM, SHOULDER, AND HAND**
HTN	**HYPERTENSION**
DM	**DIABETES MELLITUS**

S.NO	UHID	AGE	SEX	SIDE	DIAGNOSIS	CO-MORBIDITIES	TREATMENT		VISUAL ANALOGUE SCALE (VAS)					QUICK-DASH					OXFORD ELBOW					MAYO ELBOW SCORE				
							PRP	STEROID	PRE	POST	1M	3M	6M	PRE	POST	1M	3M	6M	PRE	POST	1M	3M	6M	PRE	POST	1M	3M	6M
1	70683	30	MALE	RIGHT	R-LE	NO		CS	8	8	5	4	4	76	76	65	45	23	64	64	70	78	82	64	64	73	75	83
2	48027	60	FEMALE	RIGHT	R-LE	HTN/DM		CS	8	8	6	4	3	80	80	52	46	24	62	62	74	80	84	62	62	74	78	82
3	68026	40	FEMALE	RIGHT	R-LE	NO		CS	8	8	5	4	4	74	74	60	41	23	66	66	74	78	82	62	62	74	78	83
4	71099	60	FEMALE	RIGHT	R-LE	NO		CS	8	8	6	5	3	82	82	73	58	22	66	66	72	78	84	64	64	72	72	84
5	70614	30	MALE	RIGHT	R-LE	NO		CS	8	8	5	4	3	80	80	65	41	21	64	64	74	78	82	62	62	73	78	84
6	61464	61	FEMALE	LEFT	L-LE	DM		CS	9	9	7	6	4	71	71	60	52	23	66	66	72	80	84	64	64	72	78	82
7	71157	47	MALE	LEFT	L-LE	NO		CS	8	8	6	5	4	77	77	61	46	22	64	64	72	78	82	62	62	74	75	83
8	41848	53	MALE	LEFT	L-LE	DM		CS	8	8	6	4	3	80	80	51	46	21	66	66	74	80	84	64	64	74	78	82
9	78926	56	MALE	LEFT	L-LE	NO		CS	8	8	5	4	4	76	76	65	45	22	64	64	70	78	82	64	64	73	75	83
10	85861	40	FEMALE	RIGHT	R-LE	NO		CS	8	8	6	4	3	80	80	51	45	21	62	62	74	80	84	62	62	74	78	82
11	97903	46	MALE	RIGHT	R-LE	NO		CS	8	8	5	4	3	74	74	60	40	22	66	66	74	78	82	62	62	74	78	83
12	92666	45	MALE	LEFT	L-LE	NO		CS	8	8	5	4	4	76	76	65	45	22	64	64	70	78	82	64	64	73	75	83
13	107690	50	FEMALE	LEFT	L-LE	DM		CS	8	8	6	4	3	80	80	51	45	21	62	62	74	80	84	62	62	74	78	82
14	81723	22	MALE	RIGHT	R-LE	NO		CS	8	8	5	4	3	74	74	60	40	22	66	66	74	78	82	62	62	74	78	83
15	95943	45	MALE	RIGHT	R-LE	NO		CS	8	8	6	5	3	82	82	73	57	21	66	66	72	78	84	64	64	72	78	84
16	35692	21	MALE	LEFT	L-LE	NO		CS	8	8	5	4	3	80	80	65	40	21	64	64	74	78	82	62	62	73	78	81
17	147499	40	FEMALE	LEFT	L-LE	NO		CS	9	9	7	6	5	71	71	60	51	23	66	66	72	80	84	64	64	72	74	82
18	72438	45	MALE	RIGHT	R-LE	HTN		CS	8	8	6	5	3	77	77	60	57	21	64	64	72	78	84	62	62	74	78	84
19	83676	42	MALE	RIGHT	R-LE	NO		CS	8	8	6	5	3	82	82	73	57	22	66	66	72	78	82	64	64	72	78	84
20	73573	24	MALE	RIGHT	R-LE	NO		CS	8	8	5	4	4	76	76	65	45	22	64	64	70	78	82	64	64	73	75	83
21	66607	22	MALE	LEFT	L-LE	NO		CS	8	8	6	5	3	80	80	73	57	21	66	66	72	78	84	64	64	72	78	84
22	88757	45	MALE	RIGHT	R-LE	NO		CS	8	8	5	4	3	80	80	65	40	22	64	64	74	78	82	62	62	73	78	84
23	70708	21	MALE	LEFT	L-LE	NO		CS	8	8	5	4	3	76	76	65	45	21	64	64	70	78	82	64	64	73	75	81
24	72363	40	FEMALE	LEFT	L-LE	NO		CS	8	8	6	4	3	80	80	51	45	22	62	62	74	80	84	62	62	74	78	83
25	144509	50	MALE	RIGHT	R-LE	HTN/DM		CS	8	8	5	4	3	80	80	60	40	21	62	62	74	78	82	62	62	74	78	84
26	147681	22	MALE	RIGHT	R-LE	NO		CS	8	8	5	4	3	78	78	60	42	22	64	64	76	80	84	64	64	73	78	83
27	145912	60	FEMALE	RIGHT	R-LE	DM		CS	8	8	6	5	4	76	76	58	40	23	62	62	78	82	82	64	64	75	78	82

S.NO	UHID	AGE	SEX	SIDE	DIAGNOSIS	CO-MORBIDITIES	TREATMENT		VISUAL ANALOGUE SCALE (VAS)					QUICK-DASH					OXFORD ELBOW					MAYO ELBOW SCORE				
							PRP	STEROID	PRE	POST	1M	3M	6M	PRE	POST	1M	3M	6M	PRE	POST	1M	3M	6M	PRE	POST	1M	3M	6M
1	44015	60	MALE	LEFT	L-LE	DM/HTN	PRP		8	8	6	4	2	68	68	63	46	23	60	60	67	78	92	65	65	75	80	95
2	72990	28	MALE	LEFT	L-LE	HTN	PRP		8	8	6	5	2	77	77	60	51	17	58	58	64	80	93	60	60	70	80	90
3	72034	40	MALE	LEFT	L-LE	NO	PRP		7	7	5	5	3	69	69	57	40	17	60	60	73	79	94	65	65	75	85	95
4	71498	17	MALE	RIGHT	R-LE	NO	PRP		8	8	6	4	2	69	69	63	46	23	60	60	67	78	92	65	65	75	80	95
5	70708	21	MALE	RIGHT	R-LE	NO	PRP		7	7	5	4	3	69	69	57	40	17	60	60	73	79	94	65	65	75	85	95
6	142317	38	MALE	LEFT	L-LE	NO	PRP		8	8	7	4	3	77	77	61	51	17	58	58	64	80	93	60	60	70	80	90
7	52986	55	FEMALE	RIGHT	R-LE	DM	PRP		8	8	6	5	2	72	72	61	50	23	62	62	68	76	92	65	65	70	75	95
8	48627	58	MALE	LEFT	L-LE	NO	PRP		7	7	6	4	2	77	77	69	46	23	58	58	67	78	92	60	60	75	80	95
9	37891	43	FEMALE	LEFT	L-LE	NO	PRP		8	8	7	4	3	77	77	61	51	17	58	58	64	80	93	60	60	70	80	90
10	48627	48	MALE	LEFT	L-LE	NO	PRP		8	8	6	5	2	72	72	61	51	17	62	62	68	76	92	65	65	70	75	95
11	36801	33	MALE	RIGHT	R-LE	NO	PRP		8	8	6	5	2	74	74	60	50	23	62	62	68	76	92	55	55	70	75	95
12	47921	33	MALE	RIGHT	R-LE	NO	PRP		7	7	5	4	3	69	69	57	40	17	60	60	73	79	94	65	65	75	85	95
13	46321	43	MALE	LEFT	L-LE	NO	PRP		8	8	6	4	2	69	69	63	46	23	60	60	67	78	92	65	65	75	80	95
14	898196	35	MALE	RIGHT	R-LE	NO	PRP		8	8	7	4	3	74	74	61	51	17	64	64	74	80	93	60	60	70	80	90
15	903859	43	FEMALE	RIGHT	R-LE	HTN	PRP		8	8	6	5	2	80	80	69	50	23	64	64	78	86	92	65	65	75	85	95
16	901281	38	MALE	RIGHT	R-LE	NO	PRP		7	7	5	5	3	69	69	57	40	17	60	60	73	79	94	65	65	75	85	95
17	66855	50	MALE	RIGHT	R-LE	DM	PRP		8	8	6	4	2	69	69	63	46	23	58	58	64	80	93	65	65	75	80	95
18	931146	43	MALE	LEFT	L-LE	NO	PRP		8	8	7	4	3	77	77	61	51	17	58	58	64	80	93	60	60	70	80	90
19	50912	41	FEMALE	LEFT	L-LE	NO	PRP		8	8	6	5	2	72	72	61	50	23	62	62	68	76	92	65	65	70	75	95
20	48627	48	MALE	LEFT	L-LE	DM/HTN	PRP		8	8	7	4	3	77	77	61	51	17	58	58	64	80	93	60	60	70	80	90
21	37891	46	MALE	LEFT	L-LE	NO	PRP		8	8	6	5	2	72	72	61	50	23	62	62	68	76	92	65	65	70	75	95
22	56705	29	MALE	LEFT	L-LE	NO	PRP		8	8	6	4	2	69	69	63	46	23	60	60	67	78	92	65	65	75	80	95
23	38891	36	MALE	RIGHT	R-LE	NO	PRP		8	8	7	5	3	74	74	57	51	17	60	60	72	78	93	65	65	70	75	90
24	71065	21	MALE	RIGHT	R-LE	NO	PRP		8	8	7	6	3	74	74	57	51	17	60	60	72	78	94	65	65	70	75	90
25	899207	45	FEMALE	LEFT	L-LE	NO	PRP		8	8	6	4	2	80	80	69	51	17	60	60	76	83	92	55	55	70	80	95
26	72466	59	FEMALE	LEFT	L-LE	DM	PRP		8	8	7	6	3	74	74	57	51	23	60	60	72	78	92	65	65	70	75	90
27	67933	22	MALE	RIGHT	R-LE	NO	PRP		8	8	6	4	2	80	80	69	51	23	60	60	76	83	93	55	55	70	80	95