

Original Research Article

Functional outcome after autologous blood injection for tennis elbow

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ABSTRACT

Background: Tennis elbow is one of most common conditions found in athletes involved in upper limb sports. It has been reported that local injection of autologous blood in tennis elbow offers significant benefit by providing the necessary cellular and humoral mediators to induce a healing cascade. The objective of this study was to assess the efficacy of autologous blood injection in the treatment of tennis elbow.

Methods: 30 consecutive patients involved in upper limb sports and suffering from tennis elbow for more than 3 months duration not responsive to oral medication or other non-invasive treatment were given local injection of 2 ml autologous blood. Patients were assessed using the visual analogue scale (VAS) for pain and Nirschl scores before giving injection and at 1, 4, 8 and 12 weeks also at 6 and 9 months, repeat injection was given at 8 weeks if pain persisted.

Results: After Autologous blood injection (ABI) at 4 weeks there is significant ($P < 0.001$) decrease in VAS pain score and Nirschl score. Though VAS pain score and Nirschl stage continued to improve after 8 weeks, but statistically not significant.

Conclusions: Autologous blood injection significantly improved clinical function and pain scores in patients with chronic tennis elbow who had previously undergone unsuccessful non-invasive treatment.

Keywords: Tennis elbow, Injection, Blood

INTRODUCTION

Tennis elbow is one of most common overuse injuries encountered in athletes involved in upper limb sports especially racquet sports like tennis and badminton. Pain around the lateral epicondyle is commonly referred to as “tennis elbow” but it is more frequently encountered in general public, tennis players make up only 10% of the patient population.^{1,2} Half of tennis players develop pain around the elbow, of which 75% represent true tennis elbow.³

Tennis elbow is also known as lateral epicondylitis is most common cause of lateral elbow pain treated by orthopedic surgeon or sports physician, it affects both male and females equally and frequent in age group of 45

to 54 years.^{4,5} Studies show higher incidence of tennis elbow in novice or recreational tennis player as compared to professional players, its attributed to faulty wrist kinematics during the backhand stroke.⁶ Usually there is a history of repetitive activity of pronation and supination with wrist in extension. Repetitive, eccentric motion of the wrist extensor muscles increases risk of injury to extensors of forearm muscles.

There is zone of hypovascularity 1 to 2 cm distal to attachment of tendon similar to supraspinatus tendon, with repeated injury causing micro trauma and tear in tendon and failed normal healing response due to hypovascularity and hypoxia causes tendinosis or tendinopathy.^{7,8} Typically ECRB is involved, But in few patient ECRL and extensors of fingers could be involved.

Varieties of methods have been used in treatment of lateral epicondylitis; no single definite and effective treatment method is available at present. Among orthopedic surgeons injection of corticosteroids for tennis elbow is common practice. Biologically, corticosteroids do not address the underlying pathobiology of tendinopathy and may result in induction of cell apoptosis and breakdown of collagen and matrix.^{9,10}

Autologous blood injection delivers blood borne cellular and humoral mediators to stimulate the regeneration process within the tendon.¹¹ Therefore, the present study has been designed to investigate the outcome after injection of autologous blood and local anaesthetic mixture for tennis elbow after 1, 4, 8 and 12 weeks also at 6 and 9 months.

METHODS

This study was a prospective interventional case series study conducted after obtaining institutional ethical committee approval. Patients aged between 18 to 65 years and involved in sports like badminton/tennis, with symptoms duration more than 3 months, and VAS pain score more than 5 were included in this study. Patient receiving systemic steroids during last 3 months, prior history of injection therapy or surgery to elbow, NSAID intake in last 48 hours, bony or articular lesions in elbow as confirmed in radiological examination, limited elbow or forearm motion, bleeding disorder, autoimmune diseases like rheumatoid arthritis of elbow, carpal tunnel syndrome other peripheral nerve injury such as radial nerve involvement, cervical radiculopathy, history of hypersensitivity to lidocaine were excluded.

The diagnosis of lateral epicondylitis was made based on presentation of pain in the lateral epicondyle exacerbated by physical activities including playing, tenderness over the origin of extensor carpi radialis brevis 5 to 10 mm distal to the lateral epicondyle, and finger palpation and pain around the extensor origin during forced dorsiflexion of the wrist and middle finger. Forty two consecutive players involved in upper limb sports presenting with lateral elbow pain to orthopedic outpatient department were evaluated for lateral epicondylitis with complete clinical history, physical and radiological examination of elbow joint (AP and lateral views) to rule out radiocapitular arthritis. MR imaging of cervical spine to rule out cervical pathology and blood investigations for autoimmune diseases and bleeding disorders carried out wherever necessary depending on the clinical history elicited.

For forty two patients with different modalities available for treatment of lateral epicondylitis like NSAIDs, wrist splints, counterforce bands also called tennis elbow bands, physical therapy in form of ultrasound therapy and stretching exercises, local injection of either steroid or autologous blood, and surgical release were discussed

with the patients. Patients were free to choose any form of treatment methods.

Out of 42 patients 32 choose autologous blood injection, eight patients choose steroid injection, all the patients gave informed consent to participate in the study and were given the right to withdraw from the study at any time without any reprisal. Out of 32 patients included in our study two patients lost in follow up so the results are for 30 patients. The process of treatment had no harm for their health, and they had authority to stop the process of treatment. In case of very rare incidence of side effects associated with autologous blood injection, patients had access to the orthopaedic surgeon in order to contact him if they encountered any of the possible adverse reactions to injection

Intervention

All patients in our study were administered 2 ml of venous blood drawn from the ipsilateral or the contra lateral upper limb and 1 ml of 2% lignocaine solution using 22 G needle, observing all aseptic precautions in the outpatient department. The needle was introduced just proximal to the lateral epicondyle and the contents were injected on the under surface of the extensor carpi radialis group of muscles by peppering technique. Patients were advised to restrain from activities involving repetitive movements of the wrist and elbow during initial 3 weeks after injection. Gentle passive stretching exercises of the extensor group of muscles were started as soon as the pain permitted.

After injection NSAIDs were prescribed only for 48 hours, patients advised for local ice application for the first 2 days. During the first 3 weeks patients were restricted from other modalities of treatment such as straps, braces, or physiotherapy. Patients began an interval wrist motion program consisting of stretching and strengthening the musculature about the wrist and elbow especially the extensor compartment of the forearm, as soon as pain decreased on twice daily basis at home. All patients were released to sporting activities as and when the patient was capable of sprint repetitions to fatigue without significant elbow symptoms, that's usually at 6 weeks after the injection and advised to gradually increase the duration and intensity of exposure.

Evaluation

Outcome in terms of pain relief was assessed using a visual analogue scale (VAS) and the Nirschl staging system.¹² Nirschl staging system has 7 phases namely; Phase 1: mild pain with exercise; resolves within 24 h, Phase 2: pain after exercise; exceeds 48 h, Phase 3: pain with exercise; does not alter activity, Phase 4: pain with exercise; alters activity, Phase 5: pain with heavy activities of daily living, Phase 6: pain with light activities of daily living; intermittent pain at rest and Phase 7: constant pain at rest; disrupts sleep.

The VAS comprised a 10 cm line marked at one end with 'no pain' and at other end with 'worst pain ever'. The participant was asked to indicate where on the line he or she rates the pain on the day of presentation; repeat injection was given at 8 weeks if pain persisted. All patients were followed-up for a minimum of 9 months. Informed consent was obtained from all patients participating in this study.

RESULTS

The present study comprised of 30 patients (27 male and 3 female), 25 badminton players and 5 tennis players. All the patients were right hand dominant, and had involvement of right elbow. Average age of patients was 44.6 years (range 22-64 years). Average duration of playing was 3.2 hours (range 1 to 4.5 hours) per week for badminton and 2.8 hours (range 1.5 to 4 hours) for tennis. All the patients in this study were recreational players and almost half of them had started playing before six to eight months as given in Table 1. Only one third of patients playing badminton had taken training from coach and all the patients playing tennis had the opportunity of being coached from an expert.

Table 1: Patient characteristics.

Characteristics	
Average age in years	44.6 years
Gender	
Male	27 (90%)
Female	3 (10%)
Average duration of playing per week	
Badminton	3.2 hours
Tennis	2.8 hours

The VAS pain score and Nirschl staging during follow up period was depicted in Table 2. The severity of pain was measured at pre-injection period and at 1, 4, 8 and 12 weeks, also at 6 and 9 months by the VAS pain score and Nirschl staging as shown in Table 2 and 3. Average pre injection VAS pain score and Nirschl stage were 7.8 and 5.8 respectively, After Autologous blood injection (ABI) at 4 weeks there is significant ($P < 0.001$) decrease in VAS pain score and Nirschl score when compared with that of preinjection. No significant decrease in scores between pre injection and at first week ($P > 0.05$).

Table 2: VAS pain score during follow up period.

	Pre injection	1 week	4 weeks	8 weeks	12 weeks	6 months	9 months
VAS pain score	7.8 (1.2)	6.9 (1.2)	3.0 (1.3)	1.9 (1.1)	0.5 (1.1)	0.5 (1.0)	0.5 (1.0)
P value	---	$P > 0.05$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$

Table 3: Nirschl staging during follow up period.

	Pre injection	1 week	4 weeks	8 weeks	12 weeks	6 months	9 months
Nirschl staging	5.8(0.9)	5.4(0.9)	2.3(1.0)	1.5(0.9)	0.4(0.8)	0.3(0.7)	0.3(0.7)
P value	---	$P > 0.05$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$

At 8 weeks average VAS pain score 1.9, average Nirschl stage is 1.5. At 8 weeks 3 patients had continued symptoms though there was decrease in VAS pain score and Nirschl stage, so they received repeat ABI and it brought the VAS pain score and Nirschl stage to 0 after 3 weeks time.

VAS and Nirschl stage at 12 weeks were 0.5 and 0.4, at 6 months it were 0.5 and 0.3 respectively. Paired T test between 12 weeks and 6 months showed no significant difference ($P > 0.05$). No change in scores between 6 months and 9 months, VAS and Nirschl stage remained same. Maximum difference between VAS and Nirschl stage were between 1 week and 4 weeks, which suggests patients, had maximum benefit between 1 and 4 weeks. Though VAS pain score and Nirschl stage continued to improve after 8 weeks, but statistically not significant ($P > 0.05$). VAS pain score and Nirschl stage remain unchanged after 6 months which shows no recurrence in symptoms. One third of patients complained of increased in pain after injection during initial 48 hours in spite of consuming NSAIDS and local ice application.

DISCUSSION

Though commonly called "tennis elbow," but it is actually more common in non-tennis players. There is no current published data on the prevalence of tennis elbow in the region where the study was conducted. Lateral epicondylitis is misnomer as microscopic evaluation of the tendons does not show signs of inflammation, but rather angiofibroblastic degeneration and collagen disarray. Microscopy reveals both an excess of fibroblasts and blood vessels that are consistent with neovessels or angiogenesis, this combination of features is called angiofibroblastic hyperplasia.^{13,14}

Regan et al studied the histopathological features from 11 patients who were treated surgically for lateral epicondylitis and compared to similar tissue from 12 cadaveric specimens they found vascular proliferation was present in 10 of 11 and focal hyaline degeneration in all 11 of the surgical specimens. The features suggested that lateral epicondylitis is degenerative rather than inflammatory process. This could be the reason for the

lack of response to rest and antiinflammatory medication.¹⁵

Lateral epicondylitis was initially thought to be an inflammatory process, and thus corticosteroid injection was used.¹⁶ In spite of many studies suggesting non inflammatory but degenerative nature of tennis elbow still many orthopedic surgeons often inject corticosteroids for tennis elbow.⁷⁻⁹ Current literature suggests injection of corticosteroids gives only short term pain relief and in the midterm and long term follow up it has no role.¹⁷

Biologically, corticosteroids do not address the underlying pathobiology of tendinopathy but rather have deleterious effect and may result in induction of cell apoptosis and breakdown of collagen and matrix.¹²⁻¹⁴ A study on the effects of repeated small doses of local corticosteroid into tendons on healing, formation of adhesions, and the biomechanical properties in rabbits showed significant decreases in tendon weight, amount of adhesions, load to failure, and energy to failure in the cortisone group compared to the saline group.¹⁸

Taylor et al concluded that rabbit patellar tendons injected with autologous blood were stronger at 12 weeks.¹⁹ Chemical modifiers of cellular activity like FGF, PDGF, and TGF are carried in the blood and are known to be mitomorphogenic.⁷ Autologous blood injection delivers blood borne cellular and humoral mediators to stimulate the regeneration process within the tendon.¹⁵ Introducing autologous blood in a relatively atraumatic manner may initiate the inflammatory cascade and promote healing in an otherwise degenerative process.

In our study ratio of males to females was 9:1, its cause of females rarely involved into sports in the region study was conducted, and Average age of patients was 44.6 years (range 22-64 years).

All the patients in our study were recreational players and almost half of them had started playing before six to eight months, almost two third of patients were not coached, our study result was in accordance with Blackwell et al study of wrist kinematics in expert and novice tennis player performing backhand stroke.⁶ He attributed faulty wrist kinematics during the backhand stroke for the higher incidence of tennis elbow amongst novice tennis players. Experienced players perform backhand stroke with the wrist extended to about 23° from neutral alignment, with the wrist moving further into extension at impact. Novice players however strike the ball with the wrist flexed about 13° from neutral alignment, with the wrist moving further into flexion at impact.

The wrist kinematics and EMG data show that novice players eccentrically contract their wrist extensor muscles throughout the stroke, which could contribute to tennis elbow.

All of our patients were corrected of faulty techniques and advised to select proper racquet before being considered for autologous blood injection. After Autologous blood injection (ABI) at 4 weeks there is significant ($P < 0.001$) decrease in VAS pain score and Nirschl score, No significant decrease in scores between pre injection and at first week. At 8 weeks average VAS pain score was 1.9, average Nirschl stage was 1.5. At 8 weeks 3 patients had continued symptoms though there was decrease in VAS pain score and Nirschl stage, so they received repeat ABI and it brought the VAS pain score and Nirschl stage to 0 after 3 weeks time.

In study by Edwards and Calandruccio 9 out of 28 patients received second injection and two patients received third injection, in our study only 3 patients got second injection and none of the patients got third injection, which could be explained on the basis that in our study no patient had received corticosteroid before.¹⁵

Paired T test between 12 weeks and 6 months showed no significant difference. No change in scores between 6 months and 9 months, VAS and Nirschl stage remained same. In our study maximum difference between VAS and Nirschl stage were between 1 week and 4 weeks, which suggests patients, had maximum benefit between 1 and 4 weeks. Though VAS pain score and Nirschl stage continued to improve after 8 weeks, but statistically not significant. VAS pain score and Nirschl stage remain unchanged after 6 months which shows no recurrence in symptoms. One third of patients in our study complained of increased in pain after injection during initial 48 hours in spite of consuming NSAIDS and local ice application which could be explained by induction of local inflammation by factors present in blood.¹⁵ Even Arik et al reported 10 patients with increased pain after ABI.²⁰

CONCLUSION

Autologous blood injection significantly improved clinical function and pain scores in patients with chronic tennis elbow who had previously undergone unsuccessful non-invasive treatment. After autologous blood injection therapy 80% were relieved completely of pain even during strenuous activity. Autologous blood injection is efficient treatment modality, which is simple, cheap, with less side-effect and minimum recurrence rate.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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