



Research Article

Comparison of Local Steroid Injection and Pulsed Radiofrequency Neuromodulation for the Treatment of Mild Idiopathic Carpal Tunnel Syndrome

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Summary

Aim: The aim of this study was to compare the effectiveness of local steroid injection and pulsed radiofrequency neuromodulation for the treatment of mild idiopathic carpal tunnel syndrome.

Methods: Fifty-nine patients investigated retrospectively. The results of local steroid injection for the treatment of idiopathic carpal tunnel syndrome in 28 patients were compared with pulsed radiofrequency neuromodulation in 31 patients. The visual analogue scale and neuropathic pain scale scores were evaluated before and 1, 3 and 6 months after treatment in both groups.

Results: Following the procedure, each patient reported an absence of pain, disappearance or reduction of paraesthesia and improvement in hand function. At 1, 3 and 6 months after the procedure, there was significant improvement in visual analog scale and neuropathic pain scale scores compared to the preprocedure states in both groups. The improvement rates of preprocedure and postprocedure visual analog scale scores and neuropathic pain scale scores were similar for both groups except postprocedure sixth month scores. There was a statistically significant difference in neuropathic pain scale scores at postoperative sixth month between the local steroid injection and pulsed radiofrequency neuromodulation groups so that local steroid injection reported more effective.

Conclusion: Local steroid injection gives better long-term results than pulsed radiofrequency neuromodulation for the treatment of idiopathic carpal tunnel syndrome.

Key words: Carpal tunnel syndrome, Steroid injection, Radiofrequency neuromodulation

Hafif Dereceli İdiopatik Karpal Tünel Sendromu Tedavisinde Lokal Steroid Enjeksiyonu ve Pulse Radyofrekans Nöromodulasyon Tedavisinin Karşılaştırılması

Özet

Amaç: Bu çalışmanın amacı, hafif dereceli idiopatik karpal tünel sendromu tedavisinde lokal kortikosteroid enjeksiyonu ve pulse radyofrekans nöromodulasyon tedavisinin etkinliklerinin karşılaştırılmasıdır.

Yöntem: Lokal steroid enjeksiyonu ile tedavi edilen 28 ve pulse radyofrekans nöromodulasyon ile tedavi edilen 31 idiopatik karpal tünel sendromlu hasta retrospektif olarak karşılaştırıldı. Vizuel analog skala ve nöropatik ağrı skala skorları tedaviden 1,3 ve 6 ay sonra her iki grupta karşılaştırıldı. Girişim takibinde, ağrı varlığını ifade eden her hastada, parestezinin kaybolması ya da azalması ve el fonksiyonundaki düzelme araştırıldı.

Bulgular: Prosedürden 1,3 ve 6 ay sonra her iki grupta, vizüel analog skala ve nöropatik ağrı skala skorlarında tedavi öncesi dönemle karşılaştırıldığında önemli düzelme tespit edildi. Prosedür öncesi ve sonrası her iki grup için vizüel analog skala skorları benzer idi. Prosedür öncesi ve sonrası her iki grup için nöropatik ağrı skala skorları prosedür sonrası 6. ay hariç tutulduğunda benzerlik göstermektedir. nöropatik ağrı skala skorları skorunda, lokal kortikosteroid enjeksiyonu ve pulse radyofrekans nöromodulasyon grupları arasında postoperative 6. ayda önemli istatistiksel fark vardı.

Sonuç: Uzun dönem takipte, karpal tünel sendromu tedavisinde lokal kortikosteroid enjeksiyonu, pulse radyofrekans nöromodulasyonu tedavisinden daha iyi sonuçlar verir.

Anahtar Kelimeler: Karpal tünel sendromu, Steroid enjeksiyonu, radyofrekans nöromodülasyon

INTRODUCTION

Carpal tunnel syndrome (CTS) is a clinical syndrome manifested by symptoms and signs of irritation of the median nerve at the carpal tunnel in the wrist⁽⁷⁾. CTS is the most common type of entrapment neuropathy that has an age adjusted incidence of 105 cases per 100,000 person for years⁽⁸⁾. Most cases are idiopathic but a variety of secondary causes of CTS have been reported like lesions in carpal tunnel, metabolic and physiologic causes, infection, neuropathies and inherited disorders⁽³⁾. Many causes like increased intracarpal pressure, decreased median nerve mobility, increased stiffness of the retinaculum and synovium, relative thenar muscle hypertrophy and flexor tendon tightening could be responsible from this syndrome⁽²⁰⁾.

General symptoms are numbness and tingling on first 2 or 3 fingers, pain on the wrist and especially nocturnal worsening of the symptoms. Diagnoses could be made by physical examination and clinical findings that supported with electrodiagnostic tests and radiological investigations. Clinical findings could be positive Tinel and Phalen tests, sensory examination, palpation of the wrist, strenght test and observation of thenar atrophy⁽²⁰⁾.

Treatment modalities of CTS is varied from conservative management to surgical release of median nerve. Conservative treatments could be exemplified as local

injections, splinting, nerve gliding, carpal bone mobilization and radiofrequency neuromodulation^(3,7,18). These treatments are usually offered to those with mild to moderate symptoms. Local steroid injection proximal or into the carpal tunnel improves nerve conduction velocity, symptom severity and functional scores in patients with the anti-edema and anti-inflammatory effects of steroids^(3,7). The exact mechanism of pulsed radiofrequency neuromodulation (PRN) is still unknown but it is believed to provide reduction in pain from the use of electrical fields in the absence of neural injury⁽¹⁶⁾.

The aim of this study was to compare the results of local steroid injection and PRN for the treatment of mild idiopathic CTS.

MATERIAL AND METHODS

We inspected 106 patients being treated for carpal tunnel syndrome retrospectively from January 2012 to September 2013 at our Algology department. All conservative treatments including PRN and local injections are offered to all mild CTS patients routinely. Exclusion criterias were bilateral CTS, systemic diseases like hypothyroidism and diabetes mellitus, body mass index above 30, cervical disc herniations, occupational cause of CTS and be treated with additional modality during six months follow up. 28 patients underwent local steroid injection, and 31 patients underwent pulsed radiofrequency neuromodulation whom treated by the same algologist were selected for the

study. All selected patients had nocturnal worsening of pain, positive Phalen and Tinel tests as clinical findings. Electromyography tests were reported only prolongation of sensory distal latencies that classified as mild form of CTS. Informed consents were obtained from all the included patients before procedures.

Although clinical signs and symptoms are being used to evaluate the outcome measurement of treatment of CTS, some disease questionnaires like Boston Carpal Tunnel Questionnaire, Michigan Hand Outcome Questionnaire, Disability of arm-shoulder-hand, Upper Extremity Functional Scale, Neuropathic Pain Scale (NPS) and Visual Analog Scale (VAS) have been developed. We used VAS (zero is the lowest to ten for the worst pain) and NPS scores were evaluated before and at 1, 3 and 6 months after the procedures in the morning.

The procedures were performed with each patient in a supine position and the affected arm lying at the patient's side. All patients underwent cardiac monitorization and saturation management with pulse oximetry. Intravenous midazolam 0.05 mg/kg and fentanyl 0.02 mg/kg were used for sedation. Lidocaine 20 mg was used for local anaesthesia. An eZono™ 3000 portable ultrasonography (USG) with an 8-Hz linear probe was used to locate the carpal tunnel.

Local steroid injection was made with a 22 G spinal needle. 2 cc injection solution was prepared with 40-mg triamcinolone (1 cc) and 20-mg lidocaine (1 cc).

The NeuroTherm® NT1000 RF Generator was used for PRN. The radiofrequency needle was 22 G and 10-cm long with a 5-mm active tip. Pulse duration was 10 min and impedance was 220–240 ohm.

Statistical Analyses

IBM SPSS Statistics Base 20 was used for statistical analyses. Wilcoxon analysis was used for comparison of the VAS and NPS values in the local steroid injection and

pulsed radiofrequency neuromodulation groups. The Mann Whitney-U test was used for the comparison of the unpaired groups. Results were considered statistically significant if $p < 0,05$.

RESULTS

The mean age of patients with local steroid injection was 51.43 ± 11.47 y (range 37–84), the mean age of patients with pulsed radiofrequency neuromodulation was 55.3 ± 9.48 y (range 38–74). Immediately after the operation, all patients reported resolution or significant improvement of paraesthesia and pain. The patients' VAS and NPS scores were evaluated before procedure and 1, 3 and 6 months after the procedure.

The preprocedure VAS score (VAS0) in the local steroid injection group was 7.07 ± 1.09 ; the postprocedure 1-month VAS score (VAS1) was 1.93 ± 1.49 ; the postprocedure 3-month VAS score (VAS3) was 2.11 ± 1.47 ; and the postprocedure 6-month VAS score (VAS6) was 2.64 ± 1.66 (Table-1). The VAS0 in the pulsed radiofrequency neuromodulation group was 6.81 ± 1.19 ; the VAS1 was 1.97 ± 1.72 ; the VAS3 was 2.52 ± 1.90 ; and the VAS6 was 3.52 ± 2.26 (Table-1).

The preprocedure NPS score (NPS0) in the local steroid injection group was 7.11 ± 12.3 . The postprocedure 1-month NPS score (NPS1) was 2.71 ± 1.51 ; the postprocedure 3-month NPS score (NPS3) was 2.96 ± 1.26 ; and the postprocedure 6-month NPS score (NPS6) was 3.50 ± 1.14 (Table-2). The NPS0 in the pulsed radiofrequency neuromodulation group was 6.68 ± 1.60 ; the NPS1 was 2.87 ± 0.96 ; the NPS3 was 3.48 ± 0.89 ; and the NPS6 was 5.39 ± 1.23 (Table-2).

There was no statistical difference between the VAS0, VAS1, VAS3, VAS6, NPS0, NPS1 and NPS3 scores of the local steroid injection and pulsed radiofrequency neuromodulation groups ($p > 0,05$) (Table-1,2). However, there was a statistical difference in the NPS6 scores of the local

steroid injection and pulsed radiofrequency neuromodulation groups ($p<0,01$) (Table-2). The change in VAS and NPS scores in the steroid injection group was more than

in pulsed radiofrequency neuromodulation group. The local steroid injection was more effective than the pulsed radiofrequency neuromodulation in reading the NPS6.

Table-1: VAS score statistical results of local steroid injection and PRN procedures

	VAS0	VAS1	VAS3	VAS6
Local Steroid Inj.	7.07±1.09	1.93±1.49	2.11±1.47	2.64±1.66
PRN	6.81±1.19	1.97±1.72	2.52±1.90	3.52±2.26
P value	$p>0,05$	$p>0,05$	$p>0,05$	$p>0,05$

Table-2: NPS score statistical results of local steroid injection and PRN procedures

	NPS0	NPS1	NPS3	NPS6
Local Steroid Inj.	7.11±12.3	2.71±1.51	2.96±1.26	3.50±1.14
PRN	6.68±1.60	2.87±0.96	3.48±0.89	5.39±1.23
P value	$p>0,05$	$p>0,05$	$p>0,05$	$p<0,01$

DISCUSSION

CTS pathophysiology involves a combination of mechanical/ischemic injury to the median nerve and tenosynovitis or tendinosis within the carpal tunnel⁽⁷⁾. The incidence increases with age in men and peaks at the age 45 to 54 years in women. Studies reported a prevalence of 1% in men and 7% in women or an average of 3-4% for both sexes⁽⁸⁾. A wide range of symptoms including pain of ventral wrist and hand especially nocturnal, tingling/numbness of thumb and first 2 to 3 fingers and lateral aspect of the fourth digit, weakness of thumb adduction and opposition, autonomic features like emperature or color changes could be examined⁽²⁰⁾. Diagnoses of CTS is made with physical examination and supported by electrodiagnostic tests like electromyography or radiological methods like magnetic resonance imaging of hand

or ultrasound examination of the carpal tunnel⁽⁷⁾. Differential diagnoses including demyelinating diseases, cervical discopathies, inflammatory arthropathies, compartment syndrome, ganglions and hand tumors, complex regional pain syndromes, polyneuropathies, motor neuron diseases and infections must be eliminated before treatment^(3,7,8,20).

Treatment options for CTS include wrist splints, manuel therapy, osteopathic manipulative treatment, ultrasound or laser therapy, local injections, radiofrequency neuromodulation, surgical release of carpal tunnel and medical treatment with anti-inflammatory and corticosteroid drugs^(2,3). Treatment modalities can be choosen with the severity of the disease. In our study local steroid injection and pulse radiofrequency have been made because all patients had been reported as mild at the electromyography.

The first reported use of glucocorticoid injection in the management of CTS was by Phalen and Kendrick⁽¹⁴⁾ in 1957. Since then, corticosteroid injection has been used consistently for nearly 50 years as an effective treatment for CTS^(1,4,11,12,13). To reduce pain during the injection, steroids are usually mixed with local anaesthetics. Corticosteroids reduce inflammatory pain by inducing anti-inflammatory and anti-edema actions on the damage tissue and effect on the electrical properties of the nerve fibers. Ginanneschi et al⁽⁷⁾. inspected corticosteroid injections reduced the symptoms of CTS due to the effect on A-Beta fibers. Berger et al⁽³⁾. reported long term follow up to 1 year of 120 patients that local steroid have been injected. Most of patients had been reported a long term beneficial effect from injection.

Continuous radiofrequency ablation is a percutaneous minimally invasive technique that has been in clinical use for over 25 years⁽¹⁷⁾. PRN was first used on the dorsal root ganglion in 1998⁽¹⁹⁾. Since then it had been widely used for the treatments of mono radiculopathies, post-herpetic neuralgia, phantom limb pain, saphenous neuralgia, pudendal neuralgia, meralgia paresthetica, occipital neuralgia, idiopathic trigeminal neuralgia and many peripheral neuropathies^(5,6,9,10,15,21). The exact treatment mechanism of PRN is not clear but it is thought to provide reduction in pain from the use of electrical fields in the absence of neural injury. PRN of the median nerve in the cubital fossa for the treatment for recurrent CTS has also been reported as beneficial⁽⁸⁾.

To our investigations of literature databases, our study is the first to compare the results of local steroid injection and PRN for the treatment of mild idiopathic CTS. Our study demonstrated that local steroid injection delivered better long-term results than PRN for the treatment of CTS. Results revealed that PRN for the treatment of idiopathic CTS was effective based on VAS and NPS scores before and

1, 3 and 6 months after surgery. This was similar to the effect of local steroid injection for treatment of idiopathic CTS. The only distinction was the statistically significant difference in NPS scores at postoperative sixth month between the local steroid injection and PRN group. There was a statistical difference in the NPS6 scores of the local steroid injection and PRN group ($p<0.01$). Local steroid injection was more effective than PRN based on the NPS6. Moreover, changes in the VAS and NPS scores in the steroid injection group were greater than in the PRN group. Complications of the procedures could be bleeding, infection, and nerve injury but in our study we haven't got any.

CONCLUSION

There are many treatment modalities for CTS. An intense physical examination must be supported with electrodiagnostic tests or radiological methods for diagnosis. We investigated that local steroid injection delivers better long-term results than PRN for the treatment of mild idiopathic CTS.

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