

Original Research Article

Quality of life of carpal tunnel syndrome with non operative treatment: cohort study

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ABSTRACT

Background: Carpal tunnel syndrome (CTS) is the most common peripheral neuropathy entrapment and it interferes with the quality of life. Treatment for CTS can be divided into operative and non-operative treatment. Our objective was to compare the quality of life and pain intensity in a patient with CTS after oral treatment and local corticosteroid injection (LCI).

Methods: A prospective cohort study was conducted in 18-65 years patients with CTS. Primary outcome was to compare the quality of life post oral treatment (NSAIDs, oral steroids, gabapentin) and LCI using the Short Form-36 questionnaire. Secondary output was to compare pain intensity using Numeric Rating Scale (NRS). Mann-Whitney and independent t-test were used to assess the comparison between the treatment.

Results: Sixty CTS patients were included in this study, with 32 patients (53.33%) assigned to LCI. After observation one month, statistical analysis showed that LCI improved the quality of life better than oral in physical function and bodily pain components ($p = 0.036$ and $p = 0.047$). Injection treatment decreased pain intensity more than oral not statistically significant after 14 days ($p=0.087$), but was significant after one month ($p=0.002$).

Conclusions: Local corticosteroid injection improved quality of life and decreased pain intensity better than oral treatment after one month.

Keywords: Carpal tunnel syndrome, Non operative treatment, Quality of life

INTRODUCTION

Carpal tunnel syndrome (CTS) is the most common peripheral neuropathy entrapment that accounts for about 90% of all entrapment neuropathies. It occurs in approximately 3.8% of the general population, with the incidence rate of 276:100000 per year. Carpal tunnel syndrome occurs more frequently in women, with a prevalence rate of 9.2% in women and 6% in men. It is most often seen bilaterally at a peak age range of 40 to 60 years old.^{1,2}

Clinical manifestation of CTS includes tingling, pain or numbness in the distal distribution of the median nerve

(thumb, index, middle finger and the radial side of the ring finger), a reduction of the grip strength and function of the affected hand that worsen at night. These symptoms reduce the quality of life of patients. Wolska et al found that 86.70% of subjects had difficulty to their work, about 73.30% of subjects are reduced work performance, the need for shorter working days was reported by 60%, even 20% of those examined had to change their work professions.^{1,3}

The treatment of CTS mainly can be divided into 2 categories, namely operative and non-operative. Non-operative treatment includes physiotherapy, wrist splint, oral therapy (NSAIDs, gabapentin, oral steroids,

diuretics), local corticosteroid injection with or without guided ultrasound. Non-operative treatment is indicated in patients with first-degree STK (intermittent symptomatic) and second-degree (persistent symptomatic) based on Rosenbaum's criteria.^{1,4-6} Local corticosteroid injection is effective in reducing symptoms of severe CTS up to one month after injection and provides better clinical improvement than oral steroids for up to three months after therapy.⁷ Gurcay et al compared NSAID (meloxicam 15 mg for 3 weeks) and steroid injection. They found that none of them were more superior. Both showed clinical and electrophysiology improvement after 3 months.⁸ Erdemoglu found that gabapentin with 300-3600 mg dose showed an increase in Boston Carpal Tunnel Questionnaire (BCTQ) after 3 months.⁹ Another research showed that gabapentin was no more effective than placebo in reducing pain, paresthesias, weakness in patients with carpal tunnel syndrome.¹⁰

Our study aims to compare the quality of life as the primary outcome and pain intensity as the secondary outcome of patients with carpal tunnel syndrome after treated with oral therapy and local corticosteroid injection (LCI).

METHODS

This prospective cohort study design that is for 1 month was conducted at the Neurology Clinic in Manado over a period of five months, from October 2019 to February 2020, after obtaining clearance from the Institutional Ethical Committee. Inclusion criteria were patients diagnosed with CTS based on physical and electrophysiological examinations that met grade 1 (intermittent symptomatic) and grade 2 (persistent symptomatic) Rosenbaum and Ochoa criteria, ages 18-65 years, patients who are willing to adhere medication and fully participated, no communicative barrier. Exclusion criteria were subjects who had received steroid injection therapy or carpal tunnel surgery in the last 3 months, fractures or tumors in the wrist, pregnancy, radiculopathy, or other peripheral neuropathies in electrodiagnostic studies and if there was a contraindication for steroid use or oral medications. We included patients with bilateral CTS, and we only analyzed on the hand with more severe symptoms; if symptoms were equivalent, we analyzed the more severe electrodiagnostic results; and if both symptoms and electrodiagnostic results were equal, we analyzed only the dominant hand. Treatment was determined and given by neurologist of pain division in our department.

Treatment

Subjects were divided into two groups by nonrandomized consecutive sampling. The first group received oral medication included methylprednisolone 48 mg/day (tapering off), meloxicam 15 mg/day or gabapentin 300-1800 mg/day and the second group received

triamcinolone injected locally. For injection of triamcinolone, 10 mg (1 ml), and lidocaine 1% 1 ml, the patient sat with the forearm supported in full supination and the wrist extended. The location of injection was at the medial portion of the palmaris longus or lateral palmaris longus tendon and 1 cm proximal to the most distal wrist crease. A 25-gauge needle and sterile technique was angled 45° and 1 mL of 10-mg-per-mL triamcinolone acetonide and 1 mL of lidocaine 1% without epinephrine was injected slowly. If the patient experiences shock-like pain or paresthesias, stop the injection and redirect the needle medially.

Measures

Quality of life in both groups was assessed using the SF36 questionnaire before and after 1 month of therapy. The SF36 questionnaire consisted of 36 statements, allowing the assessment of the eight components: physical functioning (PF), role limitations because of physical health problems (RF), bodily pain (BP), general health perceptions (GH), vitality (VT), social function (SF), role limitations because of emotional problems (RE), and mental health (MH). Each of the 8 components contains an appropriate number of questions; each question is rated on a scale of 0-100. By totaling the value selected by the subject and dividing it by the number of questions, we obtained the value of the indicator of the relevant subcomponent. Using this method, the values for all 8 components were calculated. The PF, RF, BP, and GH components were totaled, allowing us to determine the physical component summary (PCS); and the VT, SF, RE, and MH components were totaled, allowing us to determine the mental component summary (MCS).

The pain intensity was assessed using NRS (Numeric Rating Scale) which is a segmented numerical horizontal bar. Patients have to select a whole number (from 0 "no pain" to 10 "worst possible pain") that best reflects the intensity of their pain.

Statistical analysis

Statistical analysis was performed SPSS version 23. Bivariate analysis to assess the changes in the quality of life and pain intensity patients before and after treatment using paired sample t-test if the data were normally distributed or test Wilcoxon if not normal. The Mann-Whitney and independent t-test were used to compare between two groups treatment.

RESULTS

Sixty patients with carpal tunnel syndrome (CTS) were involved in this study, 60% were women and about 53.30% received local corticosteroid injection therapy. The baseline characteristics of the study subjects are presented in table 1. In the assessment of the physical component (PCS) and mental component (MCS), the

result showed significantly ($p < 0.001$) higher after post treatment in both groups (table 2 and 3).

Table 1: Baseline characteristics.

Karakteristik		Median (Q1-Q3)	N (%)
Gender	Man	*	24 (40)
	Woman	*	36 (60)
Age		55 (47.5-63)	*
	≤ 55 years	*	31 (51,70)
	>55 years	*	29 (48,30)
Onset (months)		10.5 (5-15)	*
	≤1 year	*	42 (70,00)
	> 1 year	*	18 (30,00)
Dominant hand	Right	*	59 (98,30)
	Left	*	1(1,70)
Location	Right	*	35 (58,30)
	Left	*	25 (41,70)
Occupation	Self employee	*	10 (16,70)
	Government employee	*	7 (11,70)
	Labor	*	8 (13,30)
	Farmer	*	3 (5,00)
	Driver	*	2 (3,30)
	Homeworker	*	20 (33,30)
	Retirees	*	10 (16,70)
BMI		25,96±4,45 ^a	*
Phalen test	Yes	*	43 (71,70)
	No	*	17 (28,30)
Tinnel sign	Yes	*	51 (85,00)
	No	*	9 (15,00)
Grade CTS (Rosenbaum)	Grade I	*	34 (56,70)
	Grade II	*	26 (43,30)
	Grade 2	*	10 (16,70)
NCV	Grade 3	*	20 (33,33)
	Grade 4	*	19 (31,70)
	Grade 5	*	11 (18,30)
	Grade 5	*	11 (18,30)
Treatment	Oral	*	28 (46,67)
	LCI	*	32 (53,33)
Pain intensity (NRS)		5 (4-6.5)	*
	≤4	*	17 (28,30)
	>4	*	43 (71,70)
QOL (SF36)	PCS	49,96±15,85 ^a	*
	MCS	77,71 (66,91-89,16)	*

Note: a = mean±SD; BMI= body mass index; NCV=Nerce conduction velocity based on Bland criteria; LCI= local corticosteroid injection; PCS = Physical component summary; MCS= Mental component summary

Table 2: Physical component of SF36 score before and after treatment.

Treatment	PCS score (mean±SD)			p
	Before	After	Difference	
Non operative	49,96±15,85	70,62±16,76	20,66±14,41	<0,001
Oral	54,49±16,27	71,65±16,84	17,16±14,04	<0,001
LCI	45,99±14,59	69,72±16,91	23,73±14,23	<0,001

Note: PCS= Physical component summary; SD= standar deviation; LCI= local corticosteroid injection;

Table 3: Mental component of SF36 score before and after treatment.

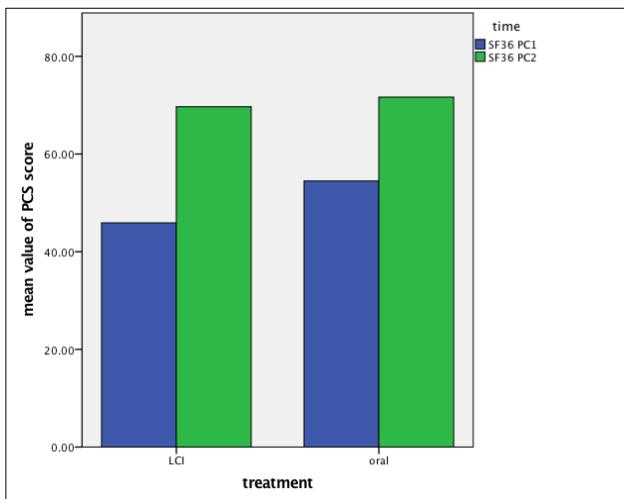
Treatment	MCS score median (Q1-Q3)			
	Before	After	Difference	p
Non operative	77,71 (66,91-89,16)	90,94 (81,84-95,50)	8,75 (3,19-16,50)	<0,001
Oral	75,65 (59,46-89,72)	91,06 (81,84-96,06)	10,29 (2,19-21,52)	<0,001
LCI	79,46 (68,74-86,34)	89,75 (81,76-95,34)	7,88 (3,88-13,90)	<0,001

Note: MCS= Mental component summary; Q1=quartile 1; Q3=quartile 3; LCI= local corticosteroid injection

Table 4: Comparison of the effectiveness of oral and LCI treatment for quality of life.

	Oral	LCI	p
PCS	17,16±14,04	23,73±14,23	0,077 ^a
MCS	10,29 (2,19-21,52)	7,88 (3,88-13,90)	0,836 ^b

Note: a =Independent t-test; b=Mann Whitney; LCI= local corticosteroid injection; PCS = Physical component summary; MCS= Mental component summary



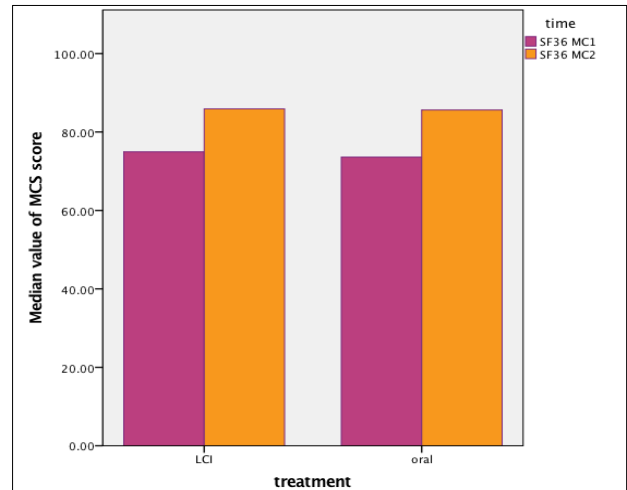
LCI= local corticosteroid injection
 SF36 PC1 = PCS score before therapy (blue colour)
 SF36 PC2 = PCS score after therapy (green colour)

Figure 1: PCS score of SF36 before and after treatment.

After one month, the patient treated with LCI showed a higher score in PCS than oral treatment, but it was not statistically significant (23.73±14.23 vs 17.16±14.04, p =0.077; table 4 and figure 1).

Oral treatment showed a higher score in MCS that LCI, but was not statistically significant also [7.88(3.88-13.90) vs 10.29(2.19-21.52), p=0.836; table 4 and figure 2].

Among the eight subcomponents, LCI improved the quality of life better than oral in physical function and bodily pain components (p = 0.036 and p = 0.047; table 5).



LCI= local corticosteroid injection
 SF36 MC1 = MCS score before treatment (green colour)
 SF36 MC2 = MCS score after treatment (orange colour)

Figure 2: MCS score of SF36 before and after treatment.

Table 5: Comparison of subcomponent scores SF36 in oral and local corticosteroid injection.

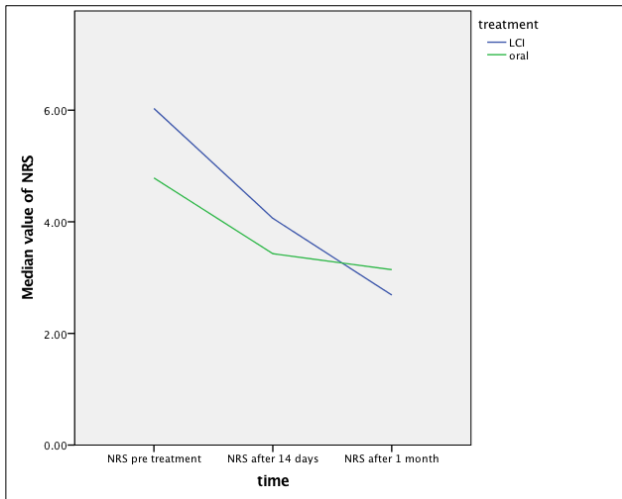
	Oral	LCI	p
PF	7,50 (0,00-15,00)	15,00 (10,00-17,50)	0,036
RF	25,00 (0,00-50,00)	50,00 (12,50-87,50)	0,207
BP	11,25 (0,00-28,75)	22,50 (11,25-32,50)	0,047
GH	10,00 (5,00-22,50)	15,00 (5,00-20,00)	0,377
SF	0,00 (0,00-12,50)	0,00 (0,00-12,50)	0,807
VT	7,50 (0,00-15,00)	10,00 (5,00-15,00)	0,359
MH	8,00 (4,00-16,00)	0,00 (0,00-8,00)	0,059
RE	0,00 (0,00-33,33)	0,00 (0,00-33,33)	0,873

Note: PF =physical functioning; RF=role limitations because of physical health problems; BP=bodily pain; GH=general health; SF=social functioning; VT=vitality; MH=mental health; RE=role limitations because of emotional problems.

Table 6: NRS before and after treatment in both groups.

	NRS score		p	NRS score		p*
	Before	After 14 days		After 1 month		
Non operative	5,00 (4,00-6,75)	4,00 (3,00-5,00)	< 0,001	3,00 (2,00-4,00)	< 0,001	
Oral	5,00 (4,00-5,75)	3,50 (3,00-4,00)	< 0,001	3,00 (2,00-4,00)	< 0,001	
LCI	5,50 (5,00-7,75)	4,00 (3,00-5,00)	< 0,001	3,00 (2,00-4,00)	< 0,001	

Note: LCI= local corticosteroid injection; NRS=numeric rating scale



blue = local corticosteroid injection (LCI)

green = oral

Figure 3: Numeric rating scale before, after 14 days and after one month in oral and local corticosteroid injection therapy.

Table 7: Comparison of NRS in oral and local corticosteroid injection.

	Oral	LCI	p
NRS 0-14 days	1,00 (1,00-2,00)	2,00 (1,00-3,00)	0,087
NRS 0-1 month	1,50 (1,00-2,00)	3,00 (2,00-4,00)	0,002

Note: LCI= local corticosteroid injection; NRS=numeric rating scale

In the assessment of NRS, there was a significant decrease in the median score of NRS after 14 days and 1-month treatment in both groups ($p < 0.001$; table 6 and figure 3).

After being tested with Mann Whitney the NRS difference between oral and injection after 14 days was not statistically significant ($p=0.087$), but was significant after one month ($p=0.002$; table 7).

DISCUSSION

Our result showed that PCS of SF36 before treated with oral treatment and LCI is significantly less than 50, which

showed that most subjects in this study had a poor quality of life physically. As for MCS, the value was more than 50, which showed that most subjects in this study have a good quality of life mentally. So, there was a greater decrease in the physical than in the mental component quality of life. Our results were consistent with Wolny et al, which were 45.53 ± 14.12 for PCS and 63.43 ± 16.98 for MCS.¹¹ Both groups, oral treatment and LCI improved quality of life physically (PCS) and mentally (MCS) significantly. These results were the same as previous studies conducted by Jarvik et al.¹² Their research found that the quality of life post nonoperative treatment was improved with a smaller difference of 2.00 (35.00 ± 10.00 vs 37.00 ± 11.00). This is because of their research has longer intervals (6 and 12 months) than ours. The duration of action of triamcinolone is 2-4 months. This might be the reason that our study with a duration of one month showed a higher value than their study whose duration was more than four months.

The increase in quality of life was found to be greater in the LCI than in the oral group but it was not statistically significant. This result might be influenced by some factors. First, the studies before comparing both groups showed improvement in pain (as part of symptom severity score) as well as in daily activities such as bathing, lifting objects, unbuttoning (parts of functional status scale). Research comparing oral treatment (oral steroids, NSAIDs, gabapentin) and corticosteroid injection was still controversial and we have not found other data comparing the quality of life in the two treatment groups. Gurcay et al and Celiker et al reported that both LCI and NSAID oral therapy in combination with splinting showed clinical and electrophysiological improvement.^{8,13} Chang research showed that low-dose oral steroid therapy was effective for short-term (1 month).¹⁴ Another study showed that gabapentin was effective to improve clinically for 1 month by using the Boston Carpal Tunnel Syndrome Questionnaire (BCTSQ).^{9,15} Second, the duration of our study was only one month, shorter than Wong et al who did not find any difference in the Global Symptom Score (GSS) between oral steroids and injections after two weeks but significantly different after eight and twelve weeks where steroid injection was better than oral.¹⁶

Although PCS total didn't differ significantly in both treatment groups, in its subcomponent, LCI increased physical function and pain subcomponent better than oral

treatment significantly. This is related to CTS major symptoms, pain, tingling, numbness and even weakness that affects daily work such as lifting things, washing, cooking. These results are different from those reported by Katz where patients who received nonoperative treatment had no significant improvement in all of their subcomponents.¹⁷ This difference might be due to their longer observation time (six months) and their study subjects had a more severe severity who came to the surgeon.¹⁷ For the SF36MC subcomponent, there was no significant difference between oral therapy and LCI. This might be influenced by one's emotional condition which is very subjective that can change quickly and also by other conditions such as economic factors, relationships with family, etc.

Pain is one of the main symptoms in patients with CTS. Our study showed there was a decreased pain intensity post-treatment in both groups. This result was similar to the study conducted by Jarvik et al and Celiker et al.^{12,13} Jarvik et al research showed an improvement in pain intensity from NRS 6.8±2.5 to NRS 5.7±3.1.¹² Celiker et al showed a decrease in pain intensity from 7.9±1.4 to 1.7±1.0 (NSAIDs and splinting) and 7.0±2.2 to 1.8±1.9 (injection).¹³

The decrease in pain intensity was found to be more in the LCI group than in the oral group and it was significant after one-month observation but not 14 days observation. According to the literature, the maximum improvement of corticosteroid injection occurs after 1 month and especially in pain and paresthesias.¹³ Triamcinolone injection is a long-acting corticosteroid, with a longer onset of action of 1-3 days and long duration of action of 2-4 months.¹⁸ NSAIDs are quickly absorbed after oral administration, peak concentrations of plasma are reached within 5-10 hours but oral administration of drugs is influenced by the process of absorption, drug degradation, metabolism, and each person has a different rate of absorption of the drug. Meloxicam reaches a steady state after 5-7 days.¹⁹⁻²¹ Chang's study et al showed that the maximum improvement for oral steroid therapy occurred after 2 weeks, usually after 5-7 days, while Herkovitz et al reported that CTS symptoms especially pain symptoms started again after 17 days.^{14,22} Besides, a study by Wong et al found no differences in the Global Symptom Score (GSS) between oral steroids and injections after two weeks in which one component of the GSS was painful.¹⁶

CONCLUSION

There is a significant improvement in the quality of life in patients with CTS after receiving non-operative treatment. Local corticosteroid injection improves the quality of life better in physical function and pain subcomponents than oral. Former treatment decrease pain intensity better than oral treatment after one month. Our study has several limitations. First, this is an observational, non-randomized study that could

potentially be biased due to treatment selection by patient. Second, we did not exclude patient carpal tunnel with diabetes mellitus which could affect the quality of life. Another limitation, this study has a short observation period. Further research should be conducted with a longer period of observation to evaluate long term effectivity from both treatments.

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