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Effects of the Treatment of Carpal Tunnel Syndrome with Surgery and Injections on the Hospital Anxiety and Depression Scale (HADS)

Domingo Ly-Pen[1], José Luis Andreu[2], Gema de Blas[3], Isabel Millán[4], Alberto Sánchez-Olaso[5]

[1]Cootehill Medical Centre, Cootehill, Co. Cavan, Ireland
[2]Department of Rheumatology, University Hospital Puerta de Hierro Majadahonda, Madrid, Spain
[3]Neurophysiology Department, University Hospital "Ramón y Cajal", Madrid, Spain
[4]Biostatistics Department, University Hospital Puerta de Hierro Majadahonda, Madrid, Spain
[5]Department of Plastic Surgery, University Hospital "Ramón y Cajal", Madrid, Spain
Email: domingoly@gmail.com

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Abstract

Background: The prevalence of carpal tunnel syndrome (CTS) and of anxiety and depression in primary care practice are high. Different studies had shown an increased prevalence of anxiety and depression in CTS patients. Nevertheless, few papers had been published studying the anxiety and depression scales in the treatment of CTS, either with corticosteroid injections (I) or with surgical decompression (S). **Objective:** To assess whether clinical improvement observed after the treatment of CTS either with I or with S correlates with an improvement in the punctuations of the Hospital Anxiety and Depression scales (HADS), at 3, 6 and 12-month follow-up. **Methods:** Randomized and open-label clinical trial, comparing I and S. Patients with symptoms suggestive of CTS (nocturnal paraesthesias) of at least 3 months duration and neurophysiological confirmation were included. Patients with clinically apparent motor impairment were excluded. The subjective evaluation of symptoms was carried out using the visual-analogue scale of pain (VAS-p). Clinical reviews were performed 3, 6 and 12 months after treatment. Each patient completed the HADS questionnaire and a VAS-p at 0, 3, 6, and 12 months. Statistical significance was established using the Student's t test and the Mann-Whitney U test when necessary. A linear regression analysis was used to know the effect of the treatment adjusted for the initial score of both scales. **Results:** 65 patients were included (30 in group I and 35 in group S). There was no statistical difference between both groups in terms of age, gender distribution, disease duration, VAS-p, neurophysiological testing severity of CTS or the 8 subscales of HADS. Both groups improved significantly in relation to the

baseline VAS-p values, in the reviews at 3, 6 and 12 months, with no significant differences between I and S. At 6 months, the reduction in the anxiety scale was around 3 points for both treatments (S = 3.6 and I = 3.2), without reaching significant differences. At 12 months, it was somewhat higher for those treated with I, but always around 3 points and without significant differences. The Depression scale score was slightly reduced at 6 months, and in a similar way for both groups (I = 1 and S = 1.19; p = 0.8). After 12 months, group I doubled the previous reduction, with group S experiencing a very slight change (I = 1.96 and S = 1.03; p = 0.3). When analysing the effect of group S on group I, the result was a reduction of 0.25 points for Anxiety (p = 0.7) and of 0.02 points for Depression (p = 0.9). **Conclusions:** Treatment of CTS with I or S results in a similar and discrete improvement in Anxiety scores on the HADS scale at 6 and 12 months. For both types of treatment, the Depression scores barely changed at 6 months, being somewhat higher in group I after 12-month follow-up. The independent effect of the S on both scales is small and not significant.

Keywords

Carpal Tunnel Syndrome, Anxiety, Depression, Local Corticosteroid Injections, Surgery, Hospital Anxiety and Depression Scales (HADS)

1. Introduction

The prevalence of carpal tunnel syndrome (CTS) [1] and of anxiety and depression in primary care practice are high [2] [3]

CTS is mainly a clinical diagnosis, although nerve conduction studies and ultrasonography can be very helpful [4] [5]. There is less controversy in the diagnosis of anxiety and depression, being both of these a pure clinical diagnosis.

Of course, both CTS and anxiety and depression can coexist in the same patient. It is easy to understand, that anxiety and depression can influence CTS symptoms; actually, anxiety and depression can influence the symptoms of any patient's comorbidity. Different studies had shown an increased prevalence of anxiety and depression in CTS patients [6].

In the last decades, a need for standardized measuring scales has surged, in order to detect emotional disturbance in patients with physical illness. One of the most commonly used anxiety and depression scales in a variety of contexts is the Hospital Anxiety and Depression Scale (HADS) [7]. HADS consists of a 7-item Anxiety subscale and a 7-item Depression subscale. Each item scores on a 4-point Likert scale, giving maximum subscale scores of 21 for depression and anxiety. HADS assesses symptomatology over the preceding week (see **Appendix 1**). Furthermore, HADS had been validated to Spanish [8].

Unlike other scales, HADS does not include symptoms that may have a physical cause (e.g., weight loss, insomnia), thus not being affected by other coexisting general medical conditions [7] [8].

The optimal treatment of CTS had not been well established until 2005. Our group published the first prospective, randomised, open clinical trial, comparing the effects of corticosteroid injections (I) versus surgical decompression (S) in the treatment of naïve CTS [9]. In summary, our results suggested that both I and S were highly effective in alleviating the symptoms of primary CTS at 12 months of follow-up. Nevertheless, I group seemed superior to S in the short term. On the contrary, S had better results than I for improving function at 12 months of follow-up. Despite all the above, few papers had been published studying the anxiety and depression scales in the treatment of CTS, either with I or with S.

In the present study, we studied whether clinical improvement observed after CTS treatment, either with I or with S, correlates with an improvement in the scores of the HADS, at 3, 6 and 12-month follow-up.

2. Patients and Methods

2.1. Study Design

This is a randomized and open-label clinical trial, comparing I and S. The study was performed in accordance with the principles of the Declaration of Helsinki. The Ethics Committees at our centres reviewed and approved the study and all patients gave written informed consent before study enrolment [9].

The original study was conducted in a primary care health centre (Gandhi Health Centre, Madrid, Spain), in cooperation with University Hospital Ramón y Cajal, Madrid, Spain (Plastic Surgery and Neurophysiology departments) and University Hospital Puerta de Hierro Majadahonda, Madrid, Spain (Rheumatology and Biostatistics departments). The recruitment of the patients was started in October 1998 and it was finished in May 2001. The first study was published in May 2005 [9].

Treatment assignments were randomly generated by computer; from every six consecutive patients, the computer assigned randomly 3 to I and 3 to S. Our Biostatistics unit provided sealed envelopes containing the treatment assignments. After patient enrolment, we opened the envelope containing the treatment assignment and the specific treatment was assigned. An intent-to-treat analysis was performed according to the number of wrists randomly assigned to I or S [9].

In our original paper, we studied the VAS for nocturnal paraesthesias, diurnal pain and functional impairment, as we believe those three kinds of symptoms are usually present in CTS show different aspects of the symptoms affecting their daily life. This was studied in the 3, 6 and 12 months of follow-up.

We also studied the responses of different subgroups, like unilateral CTS and the most symptomatic wrist in patients with bilateral CTS. The results of these analyses were similar to those found in the entire group of wrists [9].

In other papers, we studied these results extended to 2 years [10] and to 7 years of follow-up [11].

In this paper, we studied the HADS values from both I and S groups, at 3, 6 and 12 months of follow-up.

2.2. Study Population

The inclusion criteria were patients older than 18, with symptoms suggestive of CTS (nocturnal paraesthesias and pain in median nerve distribution area) of at least 3-month evolution, abnormal nerve conduction studies and willing to sign the informed consent [9].

The exclusion criteria were patients with clinically apparent motor impairment (*i.e.*: thenar atrophy), previous CTS treatment (either with corticosteroid injections or surgery), pregnancy, diabetes mellitus, hypothyroidism, inflammatory arthropathy, polyneuropathy or not signing the informed consent.

The same investigator (DL-P) evaluated all patients in the first visit, undergoing a complete clinical history and physical examination. These patients had a clinical diagnosis of CTS (mainly pain, tingling, numbness, burning sensation, or some combination of these symptoms) [9].

CTS was confirmed by nerve conduction studies, according to the method described by Kimura [9]. The same investigator (GdB) performed the nerve conduction studies of both the median and ulnar nerves of the affected side.

2.3. Treatment

The same investigator (DL-P) performed all the I by using a standard technique [9]. The corticosteroid was instilled beneath the transverse carpal ligament, from the ulnar side of the wrist, one cm proximal to the distal wrist-flexion crease and medial to the palmaris longus tendon. The 22-gauge needle was passed at a 45-degree angle distally and advanced approximately 1.5 cm in depth, where 20 mg in 1 ml of paramethasone acetonide was instilled.

The same investigator (AS-O) performed all S, on an outpatient basis. We used a limited palmar incision technique, because it is the usual surgical procedure for CTS decompression performed at our unit. This technique attempts to minimize postsurgical pain and to achieve an earlier recovery.

2.4. End Points

We used a 100-mm VAS (*i.e.* from 0 = fully asymptomatic and 100 = the most intense symptoms) to assess their level of nocturnal paraesthesias, their level of local pain, and their overall level of perceived functional impairment. This was requested at baseline and at each follow-up visit at 3, 6, and 12 months.

We were unable to use the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire because it had not been validated in the Spanish population when our study was started [9].

Each patient also fulfilled the HADS (together with the VAS) at 0, 3, 6, 12 months of treatment.

In order to simplify the results we used only the VAS of pain in this study, as

we demonstrated in our first paper [9], that both I and S groups improved in the three domains of VAS (pain, nocturnal paraesthesias and functional impairment).

2.5. Statistical Analysis

For the original study, the sample size was calculated to achieve an 80% power to detect a difference of 20 units in the percentage of wrists reaching a 20% response in VAS scores for nocturnal paresthesias between groups, as explained in our first study [9]. We assumed 70% of responders in the less favorable group, at a 5% alpha level. The calculated sample size was 72 wrists per group.

In order to establish the effects of non-independence between wrists of the same patient when patients with bilateral CTS were included and each wrist was studied separately, a 3-stage modelling framework using hierarchical linear models with 3 levels was used [9].

Statistical significance was established using the Student's t test and the Mann-Whitney U test when necessary. We used a linear regression analysis to know the effect of the treatment adjusted for the initial score of both scales.

3. Results

3.1. Characteristics of the Study Population

A total of 65 patients were included in our study: 30 were randomly assigned to I and 35 to S. **Table 1** shows the baseline characteristics of I and S groups. There was no statistical difference between groups in terms of age, gender distribution, symptoms duration, VAS-p, nerve conduction study severity of CTS or their baseline HADS 8 subscales.

3.2. Efficacy

Both I and S groups improved significantly in relation to the baseline VAS-p values, in the reviews at 3, 6 and 12 months, with no significant differences between them, as shown in **Table 2**.

In addition, other VAS (*i.e.*: for nocturnal parasesthesias and functional impairment) also improved significantly and similarly (no statistical significance) in the reviews at 3, 6 and 12 months, as shown in **Table 3**.

At 6 months, the reduction in the anxiety scale was around 3 points for both treatments (S = 3.6 and I = 3.2), without reaching significant differences. At 12 months, it was somewhat higher for those treated with I, but always around 3 points and without significant differences.

The depression scale score was slightly reduced at 6 months, and in a similar way for both groups (I = 1 and S = 1.2; p = 0.8). After 12 months, a slight worsening was observed in group I, while group S presented a slight improvement, without reaching statistical significance between groups (p = 0.3) (**Table 4**).

When analysing the effect of group S on group I, the result was a reduction of 0.25 points for anxiety (p = 0.7) and of 0.02 points for depression (p = 0.9).

3.3. Safety and Tolerability

Both procedures (I and S) were well tolerated. There were no relevant adverse effects or complications reported during the trial.

4. Discussion

The pathogenesis of CTS symptoms had been classically explained as an imbalance between the content and the volume of the carpal tunnel. Either too small carpal tunnel (constitutional, previous fracture, local lipoma…) or too much content (fluids, amyloid, glycosaminoglycans…), will result in a higher pressure inside the carpal tunnel. This higher pressure will produce median nerve symptoms, mainly nocturnal paraesthesias, pain and hand function impairment.

Table 1. Baseline characteristics of the study subjects after randomization by study group*.

	Surgery	Injection	p
Age, mean ± SD years	50.52 ± 10.87	53.17 ± 13.93	0.213
Duration of symptoms, mean ± SD weeks	31.12 ± 7.27	33.25 ± 8.17	0.723
VAS nocturnal paraesthesias, mean ± SD mm	55.63 ± 29.44	58.13 ± 28.90	0.584
VAS local pain, mean ± SD mm	42.69 ± 30.57	42.40 ± 29.36	0.951
VAS functional impairment, mean ± SD mm	39.03 ± 28.06	37.90 ± 26.36	0.793

*Patients assessed their levels of nocturnal paraesthesias, local pain, and functional impairment with the use of a 0 - 100-mm visual analogue scale (VAS), where 0 = no symptoms and 100 = the most intense symptoms. p values were determined by Student's t-test.

Table 2. Percentages of wrists reaching 70% improvement in the VAS-pain, by intent-to-treat analysis*.

3 months	Surgery	51.3
	Injection	77.1
	RR (95% CI)	0.665 (0.521 - 0.848)
	P	0.001
6 months	Surgery	70.0
	Injection	71.1
	RR (95% CI)	0.985 (0.807 - 1.201)
	P	1
12 months	Surgery	67.5
	Injection	61.4
	RR (95% CI)	1.009 (0.874 - 1.380)
	P	0.513

*The percentages of wrists reaching 70% improvement in pain visual analogue scale (VAS-pain) scores were determined based on intent-to-treat analysis. At baseline and at 3, 6, and 12 months of follow-up, patients assessed their levels of local pain using a 0 - 100-mm VAS, where 0 = no symptoms and 100 = the most intense symptoms. Categorical variables were compared by chi-square analysis, and relative risk (RR) and 95% confidence interval (95% CI) values were calculated.

Table 3. Percentages of wrists reaching 70% improvement in the VAS-nocturnal paraesthesias and VAS-functional impairment, by intent-to-treat analysis*.

Months		Nocturnal paraesthesias	Functional impairment
3	Surgery	61.3	40.0
	Injection	86.7	73.5
	RR (95% CI)	0.706 (0.582 - 0.857)	0.544 (0.404 - 0.733)
	P	0.001	0.001
6	Surgery	68.8	58.8
	Injection	69.9	65.1
	RR (95% CI)	0.984 (0.802 - 1.207)	0.903 (0.706 - 1.150)
	P	1	0.424
12	Surgery	73.8	65.0
	Injection	61.4	48.2
	RR (95% CI)	1.200 (0.968 - 1.488)	1.349 (1.025 - 1.776)
	P	0.098	0.04

*The percentages of wrists reaching 70% improvement in nocturnal paraesthesias and functional impairment visual analogue scale (VAS-nocturnal paraesthesias and VAS-functional impairment) scores were determined based on intent-to-treat analysis. At baseline and at 3, 6, and 12 months of follow-up, patients assessed their levels of nocturnal paraesthesias and functional impairment using a 0 - 100-mm VAS, where 0 = no symptoms and 100 = the most intense symptoms. Categorical variables were compared by chi-square analysis, and relative risk (RR) and 95% confidence interval (95% CI) values were calculated.

Table 4. Comparison between both groups (surgery and corticosteroid injection) at 3, 6 and 12 months follow-up in both Anxiety and Depression scales. Only in the 12 months follow-up, group corticosteroid injection doubled the previous reduction, with group surgery experiencing a very slight change.

SCALE	Treatment group	Basal	3 months	6 months	12 months
ANXIETY	Injection	5.9	4.2	3.2	3.1
	Surgery	6.2	4.0	3.6	3.2
DEPRESSION	Injection	1.9	1.3	1.0	1.5
	Surgery	1.8	1.3	1.2	1.0

None of the groups reached significant differences in any of the follow-ups.

The prevalence of symptoms of depression and anxiety in people with CTS is high. In a recent Brazilian study, the prevalence of anxiety in CTS patients was 28.7%, and the prevalence of depression was 37.6% [12]. In their study the female gender, smoking, and low family income were the most important characteristics influencing anxiety. Depression was associated with other chronic diseases, female gender and with low family income. On the contrary, healthy life styles (normal body mass index, non-smokers, active physical activity, high fruits and vegetables intake and appropriate sleeping times) were related with signifi-

cant less depression. These results match previous results from other similar studies [12].

Other studies had shown that illness behaviour (specifically depression and misinterpretation of nociception) predicts pain intensity in patients with CTS [13].

A recent study (2022) has shown that anxiety and depression were more common in patients undergoing CTS surgery than in normal individuals. They studied 35 CTS patients treated with surgery, randomly selected and evaluated for anxiety and depression. They used two standard questionnaires, the Center for Epidemiologic Studies Depression (CES-D) and the Spielberger State-Trait Anxiety Inventory (S-TAI). The mean score of the S-TAI anxiety and depression in the CTS group was higher than the control group ($p = 0.003$). In women, the level of the S-TAI anxiety and depression was significantly higher in the CTS group than in the control group. Nevertheless, in men, only trait anxiety was significant [14].

CTS symptoms usually are not incapacitating, but they can last for many years. Patients can have intermittent symptoms for months or years. In the long term, it is understandable that these symptoms may produce poor sleep, and in the longer term, produce or contribute to mental health difficulties (including anxiety and/or depression). On the contrary, poor mental health can also produce functional symptoms, similar to those seen in CTS [15].

Anxiety and depression are prominent features in patients diagnosed with CTS. Furthermore, anxiety and depression were associated with more CTS symptoms in the hand [6]. Having anger as a symptom was also associated with more CTS symptoms among cases. These findings emphasise the importance of psychological aspects when having hand pain or CTS symptoms as these patients might have these symptoms despite having normal nerve conduction studies [16].

As explained before, our study was conducted in a primary care setting, with naïve CTS not previously treated with S nor I. For this reason, we believe that our study represents more fairly the CTS in the general population. When we compare the different clinical trials and descriptions of cases of CTS, it is very important to consider if the study was conducted in a primary care setting or in a specialised units (for example rheumatology, orthopaedics, neurology, hand surgery, etc.). We can understand that patients referred directly from primary care may have less severe CTS than those patients who had been for a long time in a waiting list to be attended by a specialist (even more than one year). In this way, as the population in these studies is not homogeneous, it is possible that these results from specialised services are more severe cases of CTS [17]. Furthermore, patients who have done well in a primary care setting with conservative therapies (not necessarily local injections), did not need referring to specialised units (*i.e.*: rheumatology, orthopaedics, neurology, hand surgery etc.), with the consequent selection bias. For all these reasons, our study may reflect more realistically than other previous studies the CTS responses in the general popula-

tion [18].

We cannot compare our results to other studies with treatment randomised to S and I; to our knowledge, this is the first study where HADS tool is studied comparing I vs S, on a randomised basis.

5. Conclusion

Treatment of carpal tunnel syndrome with corticosteroid injections or surgery results in a similar and discrete improvement in anxiety scores on the HADS scale at 6 and 12 months. For both types of treatment, the depression scores barely changed at 6 months, being somewhat higher in the group corticosteroid injection after 12-month follow-up. The independent effect of the surgery on both scales is small and not significant.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix 1. Hospital Anxiety and Depression Scale (HADS) [7]

Tick the box beside the reply that is closest to how you have been feeling in the past week.
Don't take too long over your replies: your immediate is best.

D	A		D	A	
		I feel tense or "wound up":			**I feel as if I am slowed down:**
	3	Most of the time	3		Nearly all the time
	2	A lot of the time	2		Very often
	1	From time to time, occasionally	1		Sometimes
	0	Not at all	0		Not at all
		I still enjoy the things I used to enjoy:			**I get a sort of frightened feeling like "butterflies" in the stomach:**
0		Definitely as much		0	Not at all
1		Not quite so much		1	Occasionally
2		Only a little		2	Quite Often
3		Hardly at all		3	Very Often
		I get a sort of frightened feeling as if something awful is about to happen:			**I have lost interest in my appearance:**
	3	Very definitely and quite badly	3		Definitely
	2	Yes, but not too badly	2		I don't take as much care as I should
	1	A little, but it doesn't worry me	1		I may not take quite as much care
	0	Not at all	0		I take just as much care as ever
		I can laugh and see the funny side of things:			**I feel restless as I have to be on the move:**
0		As much as I always could		3	Very much indeed
1		Not quite so much now		2	Quite a lot
2		Definitely not so much now		1	Not very much
3		Not at all		0	Not at all
		Worrying thoughts go through my mind:			**I look forward with enjoyment to things:**
	3	A great deal of the time	0		As much as I ever did
	2	A lot of the time	1		Rather less than I used to
	1	From time to time, but not too often	2		Definitely less than I used to
	0	Only occasionally	3		Hardly at all
		I feel cheerful:			**I get sudden feelings of panic:**
3		Not at all		3	Very often indeed
2		Not often		2	Quite often
1		Sometimes		1	Not very often
0		Most of the time		0	Not at all
		I can sit at ease and feel relaxed:			**I can enjoy a good book, radio or TV program:**
	0	Definitely	0		Often
	1	Usually	1		Sometimes
	2	Not Often	2		Not often
	3	Not at all	3		Very seldom

Please check you have answered all the questions

Scoring:

Total score: Depression (D) _____ Anxiety (A) _____

0 - 7 = Normal

8 - 10 = Borderline abnormal (borderline case)

11 - 21 = Abnormal (case)

Available at: https://www.svri.org/sites/default/files/attachments/2016-01-13/HADS.pdf