Corticosteroid injection for the treatment of carpal tunnel syndrome

D O'Gradaigh, P Merry

Abstract

Objective—To compare low and high dose, and short and long acting corticosteroids in the treatment of carpal tunnel syndrome.

Methods—A randomised, controlled, single blind trial with electromyographic and subjective outcome measures.

Results—25 mg hydrocortisone is as effective as higher doses or long acting triamcinolone at a six week and six month follow up.

Conclusion—As low dose steroid is as effective, and potentially less toxic, this should be the recommended dose for injection of carpal tunnel syndrome.

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Clinical trials^{1–3} have established the value of corticosteroid injected into, or more recently,⁴ proximal to, the carpal tunnel. Doses range from 25 mg hydrocortisone¹ to 30 mg triamcinolone,² a sixfold difference when compared as equivalent doses of prednisolone.⁵ The most recent study⁴ used 40 mg of methylprednisolone, but is not comparable as it involved a proximal injection technique. Despite this variation, the efficacy of steroid injection across these studies is similar, with relief of symptoms in about two thirds of patients. Nerve injury by intraneural injection of steroid depends on the type of steroid used,⁵ and to some extent on the dose and concentration of additives. In view of these studies, our objective was to identify if a low dose corticosteroid (representing the lower end of the dose spectrum) was as effective as a higher dose (representing the higher doses of this spectrum), and whether there was a significant difference between long and short acting steroids in both symptomatic and electromyographic resolution of carpal tunnel syndrome (CTS).

Patients and methods

PATIENTS

All patients attending or newly referred to the rheumatology department with a suspected diagnosis of CTS were invited to participate. History and examination identified causes of

secondary CTS; these patients were excluded from the study. Other exclusion criteria were previous surgical treatment of CTS or steroid injection for CTS within the previous six months. Sample size was estimated for a significance level of 5% and 90% power to detect a twofold difference between groups.

DIAGNOSIS

Each patient recorded the distribution of symptoms on a hand diagram.⁷ Phalen's and Tinel's tests were carried out in the standard manner. Nerve conduction studies (NCS) compared the ulnar and median nerves, examining the symptomatic and normal hands when applicable (normal values: median nerve latency >3.7 ms, sensory amplitude >10 μ V, motor velocity >50 ms⁻¹). Inclusion for randomisation required either positive (that is, abnormal) nerve conduction studies, or a positive Phalen and Tinel test together with a classic distribution of symptoms. Patients with positive and negative NCS were randomised separately.

TREATMENT

A 1 ml injection without lignocaine was given through a 23G needle inserted at the distal carpal skin crease immediately ulnar to the palmaris longus tendon. Treatment allocation was in a randomised, patient blinded design. In the first phase, patients received 25 mg (group A) or 100 mg of hydrocortisone (group B). The control group (C) had no injection. In phase 2, patients received 20 mg triamcinolone hexacetonide (group D) or 100 mg hydrocortisone (group E). Patients were reassessed at six weeks and six months. The primary outcome measure was a subjective change in symptoms on a five point scale ("much worse" through "much better"), compared using χ^2 test for trend. Secondary outcome measures were (a) changes in the NCS data; and (b) a Phalen or Tinel test becoming negative where previously positive, compared by McNemar's test.

Results

Table 1 presents the data as combined results for patients with positive (95%) or negative (5%) NCS as there were no significant differences between their responses to treatment in any

Table 1 Percentage (and number) in each group reporting symptomatic improvement

	A	B	C	D	E
Median motor nerve latency (mean (SD))					
Before treatment	4.8 (0.21)	4.5 (0.24)	4.3 (0.32)	4.7 (0.37)	4.6 (0.28)
After treatment	4.9 (0.18)	4.4 (0.23)	4.3 (0.29)	4.6 (0.26)	4.6 (0.31)
Treatment*	25 mg HC	100 mg HC	Controls	20 mg triam.	100 mg HC
At 6 weeks	66 (21)	63 (20)	5 (1)	72 (13)	67 (14)
At 6 months†	66 (14)	50 (10)	—	61 (8)	50 (7)

*HC = hydrocortisone; triam. = triamcinolone hexacetonide.

†Only those responding at six weeks were followed up at six months.

Department of
Rheumatology,
Addenbrooke's
Hospital, Cambridge
CB2 2QQ, UK
D O'Gradaigh
P Merry

dogradaigh@camrheum.
fsnet.co.uk

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treatment group or in controls. Mean motor latency in those with positive tests are shown; other NCS data are omitted for clarity.

PHASE ONE

Thirty two patients were randomly allocated to each treatment; 20 patients in the control group. At 6 weeks, 66% of group A and 63% of group B reported their symptoms to be "better" or "much better", compared with 5% in the control group ($\chi^2=4.78$, $p<0.05$ and $\chi^2=5.71$, $p<0.02$, groups A and B respectively). There was no difference between the two treatment groups ($\chi^2=0.15$, $p>0.5$). As NCS data did not alter within either group, comparisons are not valid. Tinel's test became negative in a significant number in each treatment group but again did not differ significantly between treatment groups (data not shown). At the six month follow up of responders, two thirds of the group receiving 25 mg hydrocortisone and half of the group receiving 100 mg hydrocortisone, who had responded at six weeks, remained in remission. This difference was not significant ($\chi^2=2.255$, $p>0.05$). Once again, NCS did not show significant differences at the six month follow up.

PHASE TWO

Eighteen patients in group D received 20 mg triamcinolone, compared with 21 patients given 100 mg hydrocortisone (group E). Symptoms improved in 72% with triamcinolone, compared with 67% with hydrocortisone (not significant, $\chi^2=0.06$, $p>0.5$). Valid comparisons could not be made for NCS data. At six months, 61% of the original responders from group D and 50% of those in group E remained in remission, with no difference between the groups ($\chi^2=0.04$, $p>0.5$).

Discussion

As far as we know, this is the first randomised, blinded, controlled study of corticosteroid dose and type in the treatment of carpal tunnel syndrome. One possible explanation for the similarity in efficacy in previous studies is that the groups were different and therefore not comparable. We addressed this possibility by randomising from a single population and our results suggest that the equivalence in efficacy is a true observation.

The sample size was smaller than originally estimated in power calculations. A twofold difference between treatments was deemed to be the smallest clinically relevant treatment advantage that would balance against the increased neural injury risk predicted by the animal study.⁶ During interim analysis, the size of the difference was so small that over 5000 patients (using the six week response) would need to be treated to achieve statistical significance, though the trend in favour of the low dose group is more likely to be erroneous and that the treatments are in fact equivalent.

There may be a limit to the proportion of those presenting with CTS who are responsive to steroids, this "ceiling" accounting for the uniformity of results (low doses achieving a maximum effect which higher doses cannot

exceed). Steroid injections are believed to reduce perineural inflammation or soft tissue swelling, and may stabilise the neural membrane, thus limiting the ephaptic transmission ("cross talk") in ischaemic nerve fibres which causes symptoms. Positive symptoms—that is, paraesthesiae or pain with activity ("dynamic CTS"), may be associated with normal NCS.⁹ These patients more frequently respond to injection than those with thenar muscle atrophy or absent sensation (negative symptoms, associated with markedly impaired nerve conduction).¹⁰ We have reported that despite resolution of symptoms, NCS parameters remained unchanged. This is explained by considering that, while permanent nerve damage reflected in abnormal NCS is not repaired by the steroid (baseline NCS abnormalities therefore remaining unchanged), a reversible element produces symptoms without (additional) impairment of nerve conduction, the steroid thus resolving these symptoms without change in the NCS.

We did not exclude those with negative NCS. Grundberg has shown that NCS have a false negative rate of 8%.⁹ We have shown that a diagnostic algorithm¹¹ using Katz's hand diagram together with Phalen's and Tinel's tests offers the same diagnostic accuracy as NCS. There were no significant differences at any time between those with NCS positive or NCS negative CTS.

As CTS is primarily a symptomatic disorder, self assessment by blinded patients is the most appropriate primary outcome measure. Secondary outcomes were objective and determined by the examiner, who was aware of the treatment given, and bias cannot therefore be excluded. However, as there were no significant differences in NCS within individual treatment groups, biased assessment of clinical or electrodiagnostic tests seems unlikely.

In conclusion, the treatment of CTS with corticosteroid is effective in short and long term follow up. There are important reasons to minimise the amount of steroid used, and this study has shown that low dose hydrocortisone is as effective as higher doses of the same or alternative, longer acting, steroid preparations.

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